May 1985 No. 38

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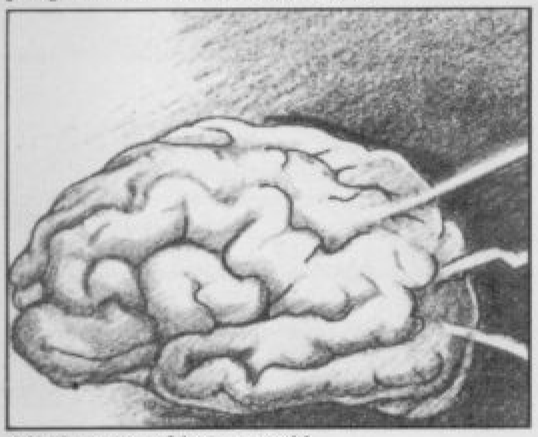
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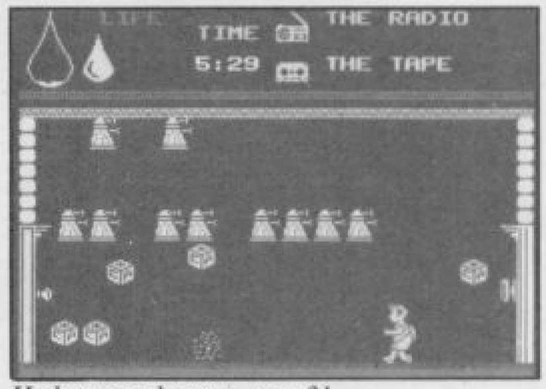
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If you would like to contribute to *Sinclair User* please send programs or articles to:
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Nordic is still alive

OUR APOLOGIES must go to Nordic Keyboards for our news story last month where we stated that Nordic had 'gone under'. Dennis Rowlands, managing director, phoned to inform us that Nordic was alive and well.

The confusion arose when Turngrade Electronics — the company which assembled keyboards for Fuller — went into liquidation with £70,000 owed to them by Fuller. Turngrade originally formed Nordic with CMC Ltd. Nordic then moved from Turngrade's premises and British Telecom was instructed to place a redirect to their new telephone number. Rowlands explains the mix-up, "BT in their wisdom placed a redirect onto a line which did not exist, which is why people couldn't contact us."

Roy Backhouse now runs a computer shop in Dale Street, Liverpool, where keyboards manufactured by Nordic were sold. "Nordic is receiving a lot of mail which should have been sent to Backhouse in Dale Street. Monies sent in for keyboards were cashed but no goods were sent out. Dissatisfied customers then contacted Nordic saying that we were responsible," says Rowlands, "Roy Backhouse has nothing to do with and has never been employed by Nordic."

For four months after the takeover, Nordic honoured the guarantee on Fuller keyboards. That situation has now changed and there is no reference to Fuller on the new Nordic keyoards. Nordic no longer hold themselves responsible for keyboards bearing the Fuller name.

Nordic has moved from its old premises at Randles Road and all correspondence should now be sent to Nordic Keyboards, % CMC Ltd, Tarran Way East, Tarran Way Industrial Estate, Moreton, Wirral, Merseyside. Tel: 051-606 9300/0088.

Dennis Rowlands sums up the situation. "We are a very reputable company and want to provide a good service to the public."

And the good news — the price of the Executive Keyboard is now £49.95 — a drop of about £10.00.

Space battle in time

MELBOURNE HOUSE has recently released **Starion**, in which you have to alter the outcome of various incidents in Earth's history.

You start off in space, fighting aliens in superfast 3D action. The game is divided into a series of time grids containing 243 time zones in blocks of nine.

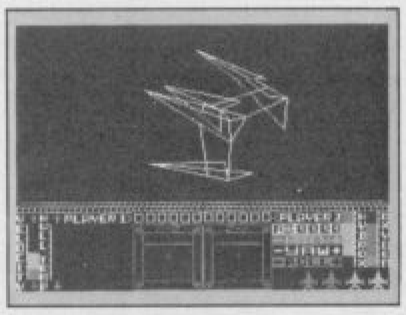
The idea is to kill the aliens in each time zone — and as they die they release an alphabetical letter. When all the aliens have been exterminated you will be left with a string of letters, which when unscrambled will form a word — the name of a cargo.

Armed with the word, you must fly through a time warp to find the timegrid and decide which of eight neighbouring time zones in the Earth's history your cargo belongs to. You then fly to Earth and see if your cargo will set history right.

You will then be transferred to eight new time grids where more battles and word puzzles take place to alter history in that time block. The process is repeated until all 243 zones have been altered and you gain the title of Creator.

Starion is not just an arcade game. It demands a general knowledge of history, the ability to make sense from a jumble of letters and an element of luck.

The game is incredibly fast with superb 3D wireframe graphics. It is available at £7.95.



Logic 3 sell budget club

LOGIC 3, which used to run a cut-price software club in addition to publishing its own programs, has gone bust. The club side of the business has already been sold to Mr Software Ltd.

The telephone number for Mr Software is (0494) 450586. Nobody was answering the phone at the time of going to press, but members of the club with outstanding orders might care to try for themselves.

Making war with Argus

SELECTED strategy games from Lothlorien are to appear as part of the Argus Software Mind Games series.

Roger Lees of Lothlorien said the wargame specialists will continue to sell other products in their own right.

Lothlorien believes the marketing support available from a large group such as Argus can make longterm survival more secure.

The first game to appear under the new deal will be **The Bulge**, a recreation of the last great German offensive of World War Two.

Pedalling into the future

INTREPID but youthful tricyclists may never have to buy petrol in their life, according to Sir Clive Sinclair. Announcing plans for further models, he described today's young teenagers with C5s as the first of the 'electric generation'.

Clive anticipated the launch of a two-seater C10 model within two years, which would have double the speed and range of the C5. That is to be followed by the *pièce de résistance*, a pear-shaped four-seater machine with a top speed of 80 mph and a range of more than 200 miles.

In the meantime, interest among retailers appears to be growing as discount chain Comet has agreed to stock the machine. "The initial response from our stores around the country has been extremely good," says managing director Jerry Mason. Comet joins an increasing gallery of outlets including selected branches of Woolworth.

Following on from previous reports of C5s going down well on oil-tankers



and holiday camps, the latest original use of the trike comes from Pontypridd in South Wales.

Local driving schools there are using C5s for pre-driving tuition, especially with older learners who suffer from 'car-fear'.

more news on page 6

Famine appeal big success

SOFT-AID, the compilation games tape sold in aid of the Ethiopian Famine Appeal, is proving a smash hit in the shops. The game has rocketed up the charts, and Lee Guinty of Microdealer UK, which distributes the tape, says sales totalled 35,000 by the second week of March.

"Demand is outstripping supply," he says. "It is difficult to put pressure on duplicators when it is for charity, and I keep running out of copies. Even little shops, whom we asked to take a minimum of ten copies, are re-ordering."

The compilation, which includes 10 chart hits sells for £4.99, of which £3.00 goes to Bob Geldof's famine appeal. Geldof also allowed the organisers to release the hit single *Feed the World* on the tape as an added bonus.

Retailers, Dixons have gone so far as to buy the game at the full £4.99 retail price, and donate every penny to the appeal. However, as with the Band-Aid single, the Government will levy VAT on the product, which amounts to 65p for each copy.

"Personally, I feel the Government could make a gesture on it," says Mark Tilson of Quicksilva, one of the main organisers of the campaign, "however the game's going very well indeed."



Disc drive withdrawn

THURNALL Electronics is withdrawing its current disc drive from the market because of lack of interest from customers.

A spokesperson for the Manchester-based company said, "We didn't get the response we needed to make the product viable."

She added that the company had no plans to introduce new disc drives for the Spectrum.

Sinclair changes terms of guarantee

OWNERS of faulty Spectrums will no longer be able to get a new one over the counter due to a change in the guarantee issued by Sinclair. The warranty still runs for one year, but unless you return the machine to the retailer within 30 days of purchase it will have to be repaired by Sinclair Research rather than replaced from existing stocks.

"At the moment shops will replace Spectrums over the counter even when they have been brought in after an 11 month pounding," says a spokesman for Sinclair Research.

The Sale of Goods Act does not fix a precise time limit, but if your Spectrum goes down after 30 days because of a manufacturing fault, you still have the right to your money back or a new machine.

The point was emphasised by a spokesman for WH Smith. "We are honouring the guarantee as offered by Sinclair," he says, "but that does not prejudice the customer's basic rights under the law."



Sinclair profit down

DISAPPOINTING profits were again dogging Sinclair Research at the beginning of 1985. The figures for the nine months before Christmas show a pre-tax profit of £7.9m, against £14m for the preceding period.

A spokesman for Sinclair Research explains that the figures include a 'highly conservative' estimate based on bad debts and other provisions. Those include £1.5m against post-Christmas returns of Spectrums, £1m due to the demise of distributors Prism, £1m on advertising in Germany and £1m from cutting prices on the Spectrum Plus after Christmas.

Nevertheless, Sinclair Research has decided to reschedule production of the Spectrum Plus. "The Spectrum sold very well over Christmas and also in January," says a spokesman, refuting reports of a slow new year. "However, most of those sales came out of large stocks because retail outlets over-ordered before Christmas. We felt it would be ridiculous to add paraffin to the fire and continue the same production levels." Stocks at the beginning of March were said to be worth £34m, and Sinclair Research has ceased buying components for new production for the time being.

While Sir Clive is clearly confident that the situation is of short-term significance only, a meeting of shareholders was called to explain the situation, given the company's expansive plans in other areas. Whether or not Sir Clive's optimism is justified, it is nevertheless acknowledged that the planned flotation of Sinclair Research on the Stock Exchange has been abandoned for the present.

Brotherly competitors

THERE was an extraordinary response to the Brother printer competition in the February issue, with the largest entry ever.

The three winners were Arthur Cummings of Peterlee, County Durham, H J P Arnold of Havant, Hampshire, and Oliver Burns of Saltash, Cornwall. Arthur wins an M1009 dot matrix printer, while Mr Arnold and Oliver Burns win an HR-5 and EP22 typewriter/printer respectively.

The answers to the six questions were 1 – Caxton; 2 – Italic; 3 – Daisywheel; 4 – Thermal; 5 – Print Buffer; 6 – Centronics. The final word, when assembled from the answers was Dot Matrix Printer.

The first answer, Caxton, to the question 'Who invented the printing press?' has roused some controversy. We are compelled to confess that the consensus of opinion suggests Guttenberg got there first and Caxton borrowed the process from him. However, no harm has been done since all who entered seem to have got Caxton anyway. It just goes to show you should not believe everything they tell you in schools.

Renaissance of Imagine

LIKE a phoenix from the ashes, Imagine, in name if not in spirit, returns from the past with new software titles. Ocean supremo David Ward, who acquired the rights to the name last October, has set up Imagine 84 to market two new arcade titles, **World Series Baseball** and **Wizadore**.

World Series Baseball is shortly to be available on the Spectrum, and is said to mimic the 'live pitch and throw of real baseball'.

In the meantime, work proceeds on the **Frankie goes to Hollywood** game, and a new project, based on *The Neverending Story*, the popular fantasy classic by Michael Ende. The hero is young Bastian Balthazar Bux, and the story follows his adventures in Fantastica as he tries to save the princess Moonchild.

"We anticipate the game will succeed on the same scale as **The Hobbit**," says David Ward. "The storyline and scenarios have a surreal fascination."

The protocol of subversion . . .

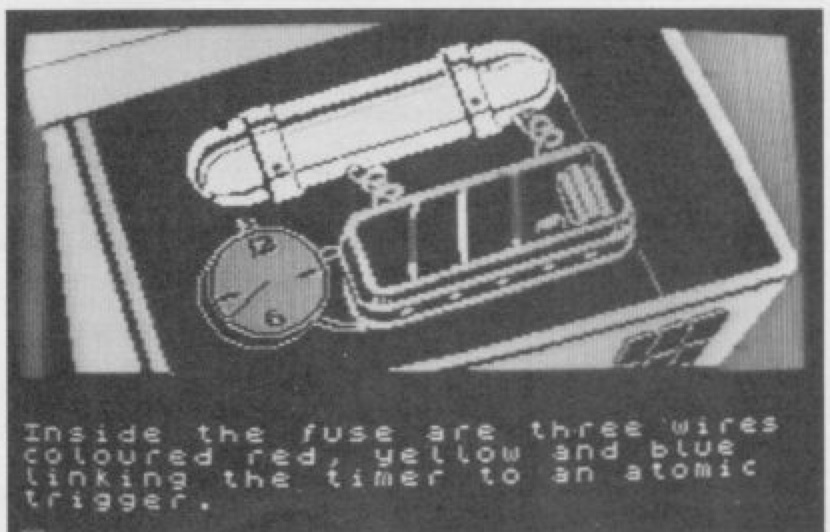
NEWS coming in about **The Fourth Protocol** suggests that the game is likely to be as big a seller as the novel, written by Frederick Forsyth.

The game has three parts, and access to parts two and three is only possible with a code word hidden in the previous section.

Part one is an icon-driven adventure in which you, MI5 investigator John Preston, runs a surveillance operation from your office. With the help of memos, files, voice prints and telephone calls you piece together the jigsaw of Plan Aurora, a Soviet plot to undermine the stability of Great Britain.

The Graphics are accomplished and generated instantaneously, and there is an innovative and imaginative use of windows.

Part two is a search sequence in the traditional adventure mould, where you travel the UK and abroad in a race against an unknown deadline. In part three, an arcade game, you arm your SAS troops for a shoot-out with the KGB.



Having successfully completed all three phases, you will find yourself face to face with the Soviet nuclear device, with only 30 seconds to defuse it. To do so correctly you must remember a fragment of information chanced upon earlier in the game, and which at the time seemed unimportant or meaningless. Depending upon your success and speed in neutralising the weapon, there are several apocalyptic climaxes to the program.

Published by Hutchinson, **The Fourth Protocol** is to be released on May 23, and will cost £12.95.

more news on page 8

Modems in danger

QCOM, the QL modem package, appears to be in dire jeopardy following the demise of OEL, which has called in the receiver.

OEL also manufactured the VTX5000 modem for the Spectrum which was marketed by Prism, also in receivership. Prism Communications which handled the modems, has been bought by Modem House and that company is now selling the Prism stocks and extending its own repair service to cover all VTX modems, whether bought through Modem House or not. If the modem was not supplied through Modem House, a charge will be made, which would be unlikely to exceed £25.00.

Spokesman Keith Rose says the company has enough stocks to serve the market for an 'indefinite' period, although with customers in 16 different countries the situation could change. "Now we're in the retailing area we will have to change our marketing strategy," he says.

"We are in a position to manufacture modems, and talks are underway concerning OEL. In an ideal world they would continue manufacturing, but the situation is very fluid."

Rose is pessimistic about the chances of QCom. "OEL cannot get the plastic to make it and it owes a lot of money to the supplier," he says.

Modem House is anxious to dispel any idea that it will simply bail out OEL, assuming it decides to become financially involved at all. "There is no point in buying OEL in its present form," he says, referring also to OEL's links with its financial backers.

For details of the repair service contact Modem House, Iolanthe Drive, Exeter, Devon EX4 9EA. Tel: (0392) 69295.

Sinclair's wafer factory

THE revolutionary new wafer scale chip is to be produced by Sinclair Research itself. The decision represents a significant change in policy by the company, which has always preferred to hire others, such as Timex, to manufacture its products.

In the case of the wafer scale chip, Sir Clive Sinclair has decided to set up a factory to manufacture the product himself.

Production schedules are geared towards 300,000 chips a year by the end of 1986, rising to 1 million in 1987. One of the first products to use the new chip will be the QL Wafer drive peripheral, but a spokesman said other companies will be able to buy the new chips if they wish.

The project will not be headed by a Sinclair man, but by ICL chairman Robb Wilmot. Wilmot's initial task will be to raise £50m in venture capital, within or without the UK. "Clive and he have known each other for a long time," says a spokesman, "we value his credibility and experience."

Wilmot will continue as chairman of ICL, but has also taken on a non-executive directorship at Sinclair Research.

The QL bounces back

FACED with a fading market image and indifferent Christmas sales, Sir Clive Sinclair gathered together those companies with QL products to present a miniature trade show for the machine in London on February 27.

Held at the London Hilton, the relaunch saw Sir Clive defending the QL against rumours that Atari's promised range of 16-bit micros would demolish QL sales.

"I don't rate Atari," he said, with something of the old Sinclair flamboyance. "We are a year ahead of them, and we have a cleverer machine, with the microdrives, for example."

Sir Clive went on to announce plans for the first waferchip product, a 0.5 megabyte storage medium which he said would be a viable alternative to Winchester drives. "Being solid state, it is more rugged than a Winchester," he said.

The product will be priced at under £300 and battery powered. It will retain data stored after the power has been switched off, and the batteries can be changed without a break in power continuity. As yet,



Sir Clive: "We are a year ahead of the competition."

said Sir Clive, there was no firm production schedule, but he hinted that it should be available by the end of the year.

New products displayed at the show included a C-compiler from GST, **Cambridge LISP** from Metacomco, and **QL Home Finance** and **Entrepreneur** from Buzzz Software and Tryptych Publishing respectively.

Doctor retrieves data

HELP IS AT hand for budding QL programmers from Glasgow software house Talent.

A comprehensive graphics package has been released to enable full-screen or part-text graphics pictures to be drawn. The package includes facilities for 16× magnification of any part of the screen plus the ability to pan the magnified picture.

Other facilities include fill, routines for 'rubber' circles and ellipses, airbrush effects, reflection and rotation. The package costs £34.95, and comprises two microdrive cartridges.

Talent is also releasing a Microdrive Doctor utility, which will retrieve corrupted data from a damaged cartridge. It will apparently deal with cartridges where data has been corrupted by faulty saving and also where the tape has suffered physical damage. Whatever data can be salvaged is transferred to a new cartridge and the contents listed.

A spokesperson points out that commercially protected software cannot be copied using the utility. "It is not part of our policy to encourage piracy," she says. The product costs £21.95 and should be available as you read this magazine.

On a marginally lighter note, CP Software are among the first established games companies to produce conversions for the QL. The first program to be released is **Bridge Player**, based on the Amstrad version of the game. The game allows the use of Stayman, Blackwood and Gerber bidding conventions, and full facilities for play, including double-dummy play, and standard play. The game retails at £18.95.

New model on the scene

YET ANOTHER QL is on the way from Sinclair Research. The JS ROM includes a new series of SuperBasic commands centred around WHEN ... ERROR statements, as well as improved microdrives.

The command checks for errors and then, instead of simply crashing the program, activates another part of the program instead. One danger is that it is non-recursive, which means that if there is an error in the new routine, the program will keep nesting the errors until it crashes completely.

Knott adds that the new ROM is not considered to constitute a major change in the QL specifications, and those changes which are significant would only be of interest to highly skilled programmers.

QL apes the big Mac

ALL FOUR Psion programs running concurrently on a QL which walks and talks tall as an Apple Mac is the claim made by Medic Datasystems for its new 'Mac User Interface'.

The package will be included free to purchasers of the company's other products which include disk drives and RAM expansions.

According to managing director Christer Skoglund the product will turn the QL into something like an Apple Mac, with single-keystroke entries and full multi-tasking.

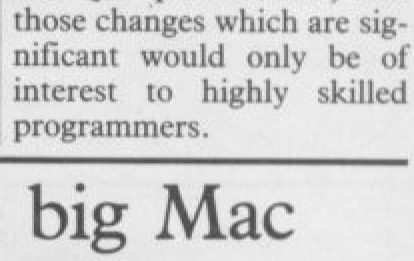
"We wish to produce a system on which people can develop better software," says Mr Skoglund. Details can be obtained from Medic Datasystems on 0256 460748.

Free Psion upgrades chopped

QLUB members will no longer be able to get the new versions of the Psion software packages as free upgrades. Instead, membership of the club is free but the packages will cost an extra £15.00 each or £50.00 for all four from Sinclair Research as a separate item.

"Even the early versions of the software were worth the money," says a spokesman for Sinclair Research. "When you consider that the Psion Xchange suite for the IBM PC costs £475 and contains the same four programs as the new versions, £50.00 is still good value."

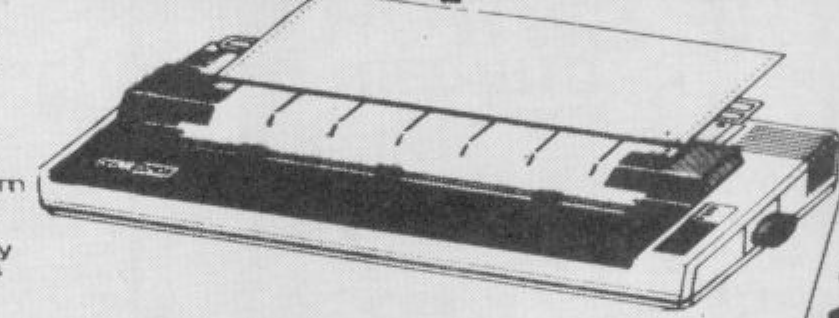
On the plus side, QLUB is providing a free telephone service which will operate from 9.30 am to 5.30 pm every weekday. Advice is promised on using printers and other peripherals, as well as help with **Easel**,



Abacus, Archive and **Quill**. Members will still be able to buy selected QL products at discount prices.

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Hands across the ocean . . .

GOD-EMPEROR of Ocean **David Ward** is relaunching the Imagine label under the name **Imagine 84,** to distinguish it from the other 83 versions which were current when the company folded, depending on which director you talked to.

Guess who balding exhippy Ward hired to head the new venture? None other than **Colin Stokes,** who was drummed out of the old company following unsavoury allegations of treason. Colin joined the gaggle of businessmen at **Software Projects** who pander to the grossly decadent tastes of **Matthew Smith,** but for some reason became dissatisfied.

"I always wanted to join Ocean when I left Imagine," burbles Colin, "but it was not to be." He then waxed lyrically about the nostalgia of it all, until a peculiar buzzing sound rendered him inaudible. Probably a Gremlin on the line . . .

But you shouldn't believe everything you hear about Ocean. Why, the other day it was suggested the whole caboodle, Ocean, US Gold and all was 96 percent owned by a shadowy intergalactic finance group run from Aldebaran. Is Ward a puppet of alien beings, or does he have green blood in his veins? Or is the whole thing a figment of a disgruntled distributor's imagination . . ?



Chunky Rod Evans of New Generation gives a lesson to squash star Jonah Barrington. The resulting confrontation led to Rod slipping a disc. Better stick to rubbish in future, Rod . . .

The poor distributors may have a right to feel disgruntled, after the way they were conned over **The Great Space Race**. Legend's awful game was hyped into the stratosphere pre-Christmas, and the trade took a dive when it flopped. Most of the blame is laid at the door of Legend supremo **John Peel.** He it was who hired a country mansion last summer for several months and filled it up with Legend programmers. TGSR – written in glorious Basic – was the result . . .

One man who can hardly be accused of hype is **Paul** 'hermit' **Duffy** of **GOSH.** Paul took over the general secretaryship from jovial, rotund **Mike Johnston.** At least Mike used to let people know what the Guild of Software Houses was up to, even when the answer was frequently 'nothing at all'. Duffy, one of the rats who left sinking ship **Prism** (who? . . . Ed.) appears to have taken a vow of silence. In the four months of Duffy's tenure nary a single press release has winged our way. Mind you, if the Guild has any sense it probably made it a condition of Duffy's employment that he *didn't* open his mouth . . .

That is not the case with **Mike Howard** of **Buffer Micro,** who has been boasting of his prowess at ejecting women from his shop. Howard claims to have thrown out one who complained about the porno pix stuck on the back wall of his Streatham emporium, saying, 'I bet she has hairy armpits.'

Caveman Howard should watch it. Quite apart from what his wife might have to say about it all, his comments are a bit rich coming from a man who used to prance about in public wearing a leotard, silk pantaloons and makeup. Or perhaps he wants to put his circus days behind him . . .

On then to **Sir Clive,** and his miserable little do at the London Hilton to launch the **QL.** Pressed on the small matter of **Atari** threatening to match his baby with its own 16-bit machine, he said "Jack Tramiel is a great guy, but he does have a habit of launching machines well before they are ready." Gasps of amazement from the assembled hacks, followed by furtive chuckles. ". . . as do we all, I suppose," continued Slugger, unperturbed . . .

The show started at 5.00pm, but before we were all kicked out at seven there was just time to meet the lads from **GST,** who were showing off their new **C-Compiler** for the QL.

So paranoid are they that they insisted any journalists who wanted a copy for review should sign a form swearing they would be fair in what they wrote. Failure to comply meant paying the full whack for the software. "GST has the most outrageous combination of arrogance and incompetence of any company in Cambridge," confided a nameless source . . .

Brazen Backslappers of the Month Award goes to **Activision,** producers of **Ghostbusters.** The publicity conscious yanks called round the *Sinclair User* offices to present editor **Bill Scolding** with a framed gold cassette, "in appreciation of your contribution to sales in excess of 250,000 units in the UK." The incorruptible Bill accepted in good grace, ignoring hoots of 'Bribe!' and staring modestly at his grubby corduroys. Considering *Sinclair User* only published a review in the March issue, it's hard to see what contribution it could have made to sales. Unless, of course, it was the small matter of the December front cover . . .



In the complete absence of any gossip about St Bruce, here's a pic of the Holy One. Software houses with vacancies to fill, beware.

Congratulations to all involved with **Soft-Aid** for their great success in raising money for Ethiopia. Thanks too to **Lee Guinty** at **Microdealer UK** for a titbit about the package. It appears Commodore 64 owners have been experiencing problems trying to load the Band-Aid music track into their machines. Spectrum owners, according to Guinty, are not afflicted with the desire to digitise **Bob Geldof**'s hit single. More confirmation that C64 lovers are the undisputed *Sun* readers of the microworld . . .

Finally, thanks to **Mikro-Gen** for once again demonstrating excellent taste by sending us a promotional gift for the new game, **Herbert's Dummy Run.** It's a disposable nappy, with 'There's a Big One coming your way' printed on it in blue. The product is the message, as some wise adman once said . . .

NEW!

12.95 COMPLETE

THE GAMES PLAYER

Our latest Interface for the Spectrum is the ultimate in games playing accessories. Not only is it a joystick-interface but also a games speed controller. This interface will enable you to become the master of any computer game.

Joystick Interface

When playing any game at normal speed the interface has all the features you would expect from a DK product. It is compatible with almost all games currently on the market and is fully Microdrive compatible. The port simulates in (31) command and will accept any joystick fitted with a 9 way D plug including the rapid fire types. (e.g. QuickshotII).

Freeze Feature

The secret of the interface is the "Freeze" control, after slotting the interface onto your Spectrum's expansion port you can adjust the speed of any game or program and even "freeze" frames simply by turning the speed control. The games controller has an extremely wide appeal; young children, the disabled, less experienced games enthusiasts, programmers and software developers will find individual benefits, you can slow games down to a complete stop and so improve your skills and high scores. You can also freeze individual screens to examine them in more detail. The freezer adds a new dimension to your games playing (or cheating).

Quickshot II Joystick

The perfect companion for your games controller, the Quickshot II offers the following features: Super positive response. 2 fire buttons. Stabilising suction grips. 4ft lead. Improved control grip. Trigger fire button. Rapid fire option. At only £11.95, it represents superb value for money.

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How to Order

The Games Player Interface costs only £12.95 and like all our products is covered by a comprehensive guarantee. You can obtain your interface from any good computer store or by completing the order form below and returning it to: *dk'Tronics Ltd, Shirehill, Saffron Walden, Essex.* or by telephone, quoting your Access or Barclaycard number.
Orders normally despatched within 24 hours.

Please rush me:

.... *Spectrum Games Controllers @ £12.95* ....
.... *Quickshot II Joysticks* .... *@ £11.95* ....
add postage and packing £1.50
Total: ______

I enclose cash/cheque/Postal Order. Please charge my
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Signature .... SU

Should women review games?

OVER the past couple of months I have noticed a substantial increase in the number of software reviews. I notice the review team seems to be split 50/50 male and female, and welcome as it may be to have women in the business I wonder if it gives a true reflection of the user base on the Spectrum. I have often wondered what qualifies a person to pass judgement on other people's products, particularly since so many mistakes are made.

Some reviews suffer from misinterpretation and oversights, or simply not reading the instructions properly. That is unacceptable as it may damage the sales potential of some programs.

I would also like to reply to a letter from Miles Sturt who claims to be the first person to finish **Beach-Head.** As the co-author of this program I would like to set the record straight. The highest known score is 382,000, set by myself on the day the program was completed and it was the first recorded score on the fully debugged version of the game.

Finally, you really seem to be scraping the board with your interviews recently. Since Mathew Smith there hasn't really been anyone remotely well known. Most decent programmers still design their own graphics and very good they are too. If you really want a scoop get an interview with the people behind Ashby Computer Graphics and give us some real state of the art.

David J Anderson,
Platinum Productions,
Kilwinning,
Ayrshire.

● *So, reviewers must be male because the majority of Sinclair users are male, and women are incapable of reviewing games which will be played by men. Such a pathetic, illogical attitude deserves to be treated with contempt.*

The 'mistakes' you refer to are largely a matter of opinion. Where we make genuine errors we are happy to accept the blame, and do so within the pages of the magazine.

As for our interviews, I am sure that Julian Chappell, Lee Kristofferson, David Reidy and the Automata team — all authors of best-selling games — are of interest to our readers. Perhaps you're just hurt that we haven't talked to you about your mediocre efforts. Ed.

Avalon goes walkabout

TURNING to page 68 of the March issue I read 'Richard Price investigates the introduction of arcade and animated graphics into adventures'.

Oh good, I thought, I wonder what they'll say about **Avalon.** I scanned the article but found no mention so I re-read it more carefully, searching diligently in case your typesetters had hidden **Avalon** cunningly as Avalot, Lovano or Novalon. Nothing remotely resembling the required word could I glean, nor even a passing reference to our company and its works.

Now, I know you have to demonstrate to your readers that just because I write your Helpline column every month, you are not biased in favour of our products. But **Avalon** is an 'adventure movie', equally as interesting and fun to play as **Tir Na Nog, Lords of Midnight** and the rest. So how come you missed it out?

Well, I'm a philosophical sort, but just to show there's no hard feelings, for the benefit of those readers and players who are stuck half way through the game, a detailed help sheet is available to all who send a large stamped addressed envelope to our business address.

Andrew Hewson,
Hewson Consultants Ltd,
56b Milton Trading Estate,
Milton, Abingdon,
Oxfordshire OX14 4RX.

Conflicting opinions

I WAS taken aback by your ridiculous review of Elite's **Airwolf** in your March issue.

Several people I know have the game, and they all agree that it is extremely addictive — more so than most other software on the market. There are very few programs around which have kept them glued to the screen for so long.

I see that the reviewer was Colette McDermott. She must have strange hands — she finds the keys hard to use. No one I know does.

You have a right to your opinion, but this time you seem to be in a minority.

F Thomson,
Edinburgh.

AFTER I had read the review of Elite's **Airwolf** I was very annoyed with the person who reviewed the game.

The graphics are far from dull and after the first two screens the tasks are much more exciting and difficult. It is worth more than three out of 10 as a Gilbert Factor. The reviewer mentions at the end that it resembles **Blue Thunder.** The only way in which it resembles **Blue Thunder** is that it involves a helicopter.

Chris Muir,
aged 13,
Glasgow.

● *And the only way which* ***Airwolf*** *resembles the TV series is that it involves a helicopter. Still, we do seem to be in a minority on this one. Colette — you're fired! Ed.*

Skool of high standards

CONGRATULATIONS on your excellent software review of Microsphere's **Skool Daze.** I purchased this program and your software review was perfect in describing it. Keep up the good work, *Sinclair User*.

Craig Lovelace,
Whepstead,
Suffolk.

Programs for pigs and cows

THERE are many Sinclairs in this country, but no business software available. I know of one farmer who writes his own programs, and he assures me that they are extensive, covering 2000 head of cattle, 1000 pigs, the sales data of 1100 bales of tobacco and a farm turnover of $500,000.

Do you know where I could obtain software for a 48K Spectrum, related to farming operations and in particular a wages program for about 130 workers?

H P Arnold,
Salama Farm,
PO Box 106,
Macheke, Zimbabwe.

● *D J Programs, Lawnspeedie, North Duffield, Selby, North Yorkshire, has a range of software for farmers.*

Give girls a chance

I BELONG to a computer club at my school, but, I seem to be the only female. Surely girls must own computers as well as boys.

I find computers very interesting and I think that more girls should give them a chance!

Rachel Cutts,
aged 13,
Newark,
Nottinghamshire.

Politics enter by the back door

I AM distressed at the amount of games of aggression but what I find equally disturbing is the adverts for Gremlin Graphics on pages 32 and 33, March issue. One refers to the 'nasties of the coal mining industry and their lackey socialist puppets'. On page 56 there is an advert for CCS where one game refers to playing against 'the computer's red forces.'

A common complaint against the left is that they introduce politics into everything. It seems to me that it is the software companies which are doing this.

Should software be politically neutral, or would anyone like to join me and write a program about a possible scenario where mad Ron and his pet poodle Maggie are leading the world to almost total nuclear destruction. Where all that are left in the bunkers are computer programmers having at last to exercise their minds on the complexities of moral issues instead of children's games?

Trevor Slack,
112 Heathwood Gardens,
Charlton, SE7 1ER.

Epson printer offline?

IN YOUR review of printers — July 1984, *Sinclair User* — I was surprised that you dismissed the EP44 without explanation. Now the matter has arisen again in the March 1985 issue.

I bought an EP44 in March 1984. Apart from printing the drafts of two books it has faultlessly churned out hex dumps and listings from a variety of computers as well as miscellaneous documents. The text illustration in the July 1984 review clearly showed that the EP44 produces print of excellent quality. The machine responds to typewriter and seven-bit codes as well as ASCII. That means that some useful extra characters are available.

True, it is slow — but so is a daisy wheel printer. But why the rush?

I have but two wishes as far as the EP44 is concerned: one is that it had the HR5 graphics capability; the other is that I could input **Tasword** text to the Spectrum from the EP44 keyboard. The EP44 will input text into other computers. I feel sure that a program alteration to allow text entry from any RS232 source must be simple. I am afraid I find the Interface 1 handbook almost totally opaque in many respects, including RS232 techniques. I would be delighted if someone would enlighten me.

P L Patient,
28 Youngs Rise,
Welwyn Garden City,
Herfordshire AL8 6RU.

Women make a stand

REGARDING your short news report on the Microshield VDU smock in the March edition, I found it offensive to see female computer users dismissed as being such a minor group.

No one can deny that computing is a male-dominated activity, but I should just like to make three points.

If TV radiation is harmful at all, it is not harmful only to pregnant women.

There are thousands of women in the computer industry, some of whom actually buy their own home computer — Good heavens!

A dismissive attitude that women and girls working with home computers do not matter because there aren't any to speak of, is both inaccurate and is setting a bad example to youngsters of both sexes.

Kate P Glover,
Norwich, Norfolk.

● *In remarking that the controversy surrounding TV radiation had not been raised adequately because it seemed to affect only 'pregnant women and there are few female users', we were attempting to comment ironically on the attitude of the computer industry towards women. Unfortunately, we merely appeared to condone that attitude. For the record, we do not dismiss the female user base in any way. Ed.*

Logic from confusion

THE MAYFIELD Computer Dyslexia group produces programs for the Spectrum to aid teachers and parents with dyslexic children.

All programs are in the public domain, but a small copying charge of £5.00 is made for a suite of some 20 programs, either on tape or microdrive.

There are programs to aid left/right confusion, short-term memory diagnosis, as well as spelling. A large SAE will bring further details.

Brother Henry,
Mayfield College,
Mayfield, East Sussex.

Software club to the rescue

ONCE again I put pen to paper in response to Iain Dale's plea for a ZX-81 Club.

There is one! Run by ourselves, the Software Farm Software Club — (SFSC) — has an international following. Members are encouraged to air their views, ask questions, swap information, hints, tips and hardware through the media of the Club Newsletter. ZX-81 owners can communicate with other users around the world with anything connected to their beloved but neglected little machine.

Full details of the Club are available from Software Farm.

Julian Chappell,
Software Farm,
155 Whiteladies Road,
Clifton, Bristol.

In search of the Timelord

YOU ONCE printed a review of a software adventure **The Key to Time.**

Can you please advise me from whom I can buy this program? Can you also tell me whether there have been any other *Dr Who* adventures for the Spectrum.

A J Mowat,
West Sussex.

● *It is now published by Sentient Software, Branch House, 18 Branch Road, Armley, Leeds LS12 2AQ.*

Pertaining to penfriends

I CONDUCT a private radio transmission named Radio Software, for Spectrum users. The transmission is put together by physicians at the Gaslini Hospital Sinclair Club.

We hope to collaborate with UK users by tape or letter. Write to:

Dr Giuseppe Marini,
Viale Primavera, 25 A/3
Genova.

I AM 13 years old and would very much like a penpal in the UK. I am from London, but I'm living in Swaziland for a few years. I have a 48K Spectrum inside a Transform keyboard, two microdrives, a Star Gemini printer and a Kempston joystick. My interests are games and word-processing.

Paul Owen,
PO Box 163,
Mbabane, Swaziland,
Southern Africa.

Poke around for more tips

FOR THOSE who have **Sabre Wulf** I have a poke which enables you to go twice the normal speed and also makes all animals and amulets disappear. That means that you don't need to get all the pieces of the amulet to beat Sabre Wulf, all you need to do is get into the cave. However, if you press the fire key, everything will turn back to normal as long as you are holding the fire key down.

First type in MERGE "", enter, and start your tape as if loading normally. When the header has loaded type in POKE 23756,1. Then press the edit key. Move the cursor to just before the PRINT USR command. Type in POKE 44876,0: then enter. Type in RUN. Then restart the tape. Sometimes the program crashes but that is rare.

And if there are still **Jet Set Willy** fanatics out there I have some useful pokes. For any of the pokes type in CLEAR 30000: LOAD "" CODE: (put all pokes here separated by colons) : RANDOMISE USR 33792 (ENTER) Start your tape player.

The pokes are: POKE 36353,44 – allows you to be sucked up a left hand wall; POKE 35899,0 – infinite lives; POKE 34795,x – type x as the number of the starting room, 0 to 60; POKE 36477,1 – stops you dying when you fall from a height; POKE 59900,255 – an anti-attic poke; POKE 41983,255 – get the tap from the bathroom, jump on your bed and see what happens; POKE 34275,10 – access to any room by pressing nine and another number key; POKE 36358,0 – jump higher than normal; POKE 35123,0 – deletes all baddies which move and removes ropes.

Ian Comerford,
Wallasey, Merseyside.

Ultimate brain damage

I FINISHED **Sabre Wulf** three months before it was conceived by Ultimate, and at the time I had two broken arms and was playing with my tongue. I finished half an hour before I'd started playing and blew a chip on my machine because it couldn't hold my score. My percentage was 329.

For anyone who didn't know already, when you get to a score of 17^7 the screen flashes and a message appears proclaiming you the "Hyper-intelligent astrally tantric mega-ultra Sabre Wulf lord". So there!!!

I've done **Knight Lore** about eight times – really. I completed it on January 25 with 82 percent — (Adventurer).

Please, please, no more **Sabre Wulf** letters!

Hyper-intelligent etc,
Shrewsbury, Shropshire.

Quasimodo at the top

IN REPLY to Miles Sturt's letter – March, *Sinclair User*. I have scored 3,401,627 in **Hunchback** and rescued Esmerelda nine times.

Paul Sweeney,
Manchester.

Bug invades the pitch

I HAVE bought Ocean's **Match Day** and I seem to have found a bug.

I was playing in the FA cup quarter finals and winning eight-nil. As the clock ticked to 90 I scored. The clock carried on and the circular timer was a graphical mess.

When the clock passed 100 the timer started again and carried on for 45 minutes. The final score was 14-1.

Paul Blewett,
Hayle, Cornwall.

Barricading the base

THE HIGHEST score I have achieved in **Combat Lynx** is 93,950.

It is essential that you protect Base 0 as this is your only supply of troops, fuel and weapons, you should lay mines around it. The minefields can be breached by enemy tanks and lorries.

Colin Reekie,
St Monans, Fife.

Fly through trouble

A FEW tips on **Underwurlde.** To get past the guardians without the weapon you can swing on the rope next to the room where the guardian is and then press CAPS SHIFT. You should then fly past the guardian – if not, try, try again.

K Harvey,
Keyworth,
Nottinghamshire.

Moonlighting mothers

I AM a member of that horrifying species known as Spectraholic Mums Anonymous. We're the ones who sneak off-spring's Spectrums out of their rooms in order to have a bash at Eureka's £25,000.

Can someone enlighten me as to where **Technician Ted's** diffusion furnace is and how to get there? The situation is fraught; burnt dinners are a daily occurance.

All help will be gratefully received.

Diffused-up mum,
Westcliff-on-sea, Essex.

Spectral bust-ups

I FINISHED **Ghostbusters** on December 14 and my bank account stands at $112,100; my account number is 10242021 and my code name is Peter Smith – entered Smith Peter. I claim to be a professional Ghostbuster – "Who ya gonna call?"

Frazer Smith,
Coatbridge,
Lanarkshire.

Slimed from behind

IN REPLY to Miles Sturt – letters, March, my friend Paul Humphries and I finished **Ghostbusters** on December 19 with a score of $18,000.

Since then our top score is $100,400; the account number is 02062420.

When the ghost hits you, if you failed to trap it, the man says 'It slimed me' not 'behind you' as John Gilbert thinks.

David Jenkins,
London, NW10.

Record break for jailbird

I HAVE completed **Monty is Innocent** in two minutes 20 seconds, on February 24.

Stephen Forbes,
Kincardinshire,
Scotland.

Scrambled letters

I AM a **Scrabble** enthusiast.

When I am losing, and on the last seven tiles, I find if those are fed in at random using an already accepted word as a basis the rubbish will be accepted by the computer.

TWEED had already been accepted to which I added my remaining tiles making TWEEDQKYTT. This was accepted by the computer.

T S Paterson,
Alvaston, Derby.



2 HITS ARE BETTER THAN 1
Now by public demand the screen-scorching Falcon Patrol II is available on the Spectrum 48K as well as the CBM 64.
FALCON PATROL 2
FPII
SPECTRUM 48K
COMMANDING YOUR HARRIER JUMP JET YOU MUST SINGLE-HANDEDLY DEFEND YOUR BATTERED TOWN AGAINST THE FEROCIOUS ONSLAUGHT OF ENEMY HELICOPTERS. THEY ARE USING EVERY TRICK IN THE BOOK, BARRAGES OF LETHAL MISSILES AND DEADLY GROUND-BASED FLAK-BATTERIES. RADAR JAMMERS BLIND YOUR VISION.
THERE'S NOTHING FOR IT – YOU MUST KEEP COOL AND STAY ON TOP!
STUNNING 3D GRAPHICS
ACTION-PACKED FAST SCROLLING
AERIAL COMBAT
AUTHENTIC HARRIER SIMULATION
DEVIOUS CHOPPER ATTACKS
PURE ADRENALIN
"FPII is Virgin's best game yet" – Computer and Video Games
SPECTRUM 48K VERSION AVAILABLE FROM 29th APRIL FROM ALL LEADING COMPUTER STOCKISTS.
CBM 64 version R.R.P. £8.95
SPECTRUM 48K version £6.95
"It's Unique, Graphically Impressive, Vast and Devious; in short, BRILL"... PCW Not only all this but it's NOW available on the Commodore 64.
STRANGELOOP IS A MASSIVE ARCADE ADVENTURE WITH A WEALTH OF RICH AND COLOURFUL GRAPHICS.
Commodore 64
STRANGELOOP
ON YOUR SOLE MISSION TO THE ROBOT FACTORY ON THE EDGE OF A DISTANT SOLAR SYSTEM, YOU WILL UNCOVER MANY MYSTERIES AND CHALLENGES. YOU WILL MEET ROBOTS, SOME FRIENDLY, SOME HOSTILE, SOME LETHAL AND SOME FUNNY. COUNTLESS PUZZLES LIE BETWEEN YOU AND THE SINISTER ALIEN FORCES IN THE CONTROL ROOM – YOUR ULTIMATE DESTINATION. HERE YOU MUST RE-PROGRAM THE ROBOTS TO STOP THE DESTRUCTION OF THE EARTH.
DARE YOU ACCEPT THIS MISSION???
250 SCREENINGS OF TOUGH AND CHALLENGING GAME PLAY.
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AVAILABLE FROM VIRGIN GAMES TEL: (01) 727 8070
2-4 VERNON YARD. PORTOBELLO ROAD, LONDON W.11

LAST NOVEMBER *Sinclair User* went foolishly where no other magazine had gone before, and compiled the definitive Top 50 of software classics for the Spectrum.

Failing to learn from our mistakes, we have decided to go one step beyond. Starting this month, we will attempt to grant classic status to programs as they are reviewed, rather than with the benefit of hindsight.

These **Sinclair User Classics** are programs which, in our biased and eccentric opinion, set new standards in software. They are the programs by which the others should be measured.

SINCLAIR USER CLASSIC

If you buy no other software, buy these. No self-respecting Sinclair user should be without them.

OBIT

THE Gilbert Factor, much admired and much maligned, has gone the way of all good things. Henceforth software reviews will carry a star rating, the basis of which will be value for money. Programming, graphics, speed, presentation, addictive qualities and the rest will all be taken into account, but the bottom line will be whether or not you should part with the folding stuff.

Guide to ratings
★★★★★ 24 carat. Buy it
★★★★ Value for money
★★★ Nothing special
★★ Over-priced
★ A rip-off

A Day in the Life

RUMOURS that Sir Clive has been made Dame Commander of the British Empire have been confirmed by Micromega. The epic tale of the day he set out to collect his gong takes some telling, though.

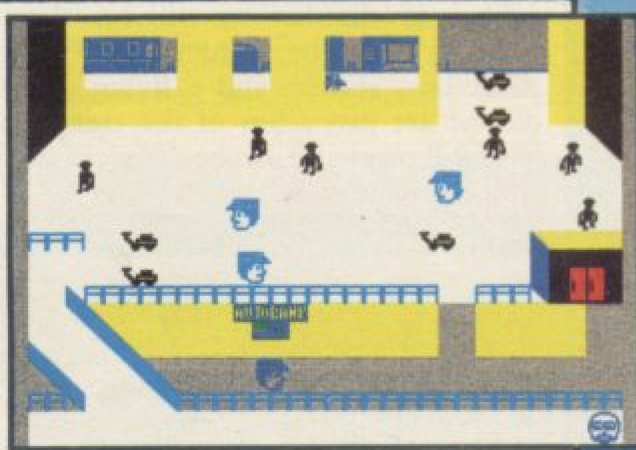
Gremlin can report that on the way to the palace Slugger Sinclair suffered a mishap at the barber's and was rendered completely bald. Even the stubbly little bits at the sides were hacked away . . .

More vignettes from the tempestuous saga include the robbing of a bank, a mad dash from the 8.15 to Euston to buy the *Financial Times* — doubtless to check up on Polecat Tebbit's conversations with the Italian typists who bought Acorn — scenes of drunken abandon in Carlos' bistro, and petty larceny at the chemists in search of a bottle of hair restorer . . .

The full version of Uncle's Big Day is told by Micromega in **A Day in the Life**, a new departure for gossip columnists in that the sordid tale is recorded on cassette, and accessed by joystick, for 27 screens of attractively clear and stylish graphics.

Slugger is represented by a rotund head with that distinctive hairstyle which has made the micro magnate the Lady Di of the computer scene. He bounces with respectable speed through the crowded streets of London, up and down stairs, all the while attempting to avoid ticket collectors, rogue gobstoppers, dancing beermugs and the like. A whiff of the Manic Miner is definitely in the air . . .

Humour and intelligence are not qualities Gremlin associates with the microworld generally, excepting of course the offices and pages of *Sinclair User*. Micromega certainly seems to



have found a private supply of its own. 20 billion unsold waterproof C5 ponchos in grey plastic to anyone who can explain how to get past the sentries at Buck House in time to hear the wonderful full BEEP version of *Land of Hope and Glory* . . .

Gremlin

Publisher Micromega **Price** £6.95
Memory 48K **Joystick** Kempston, Cursor, Sinclair
★★★★

Toy Bizarre

IF YOU have always stayed away from balloons because they make a loud bang when they pop then **Toy Bizarre** from Activision will give you a chance to get your own back.

Leap around the levels of the toy factory using Merton, your puppet guide, to pop the balloons which are blown up from six huge valves. But beware! Break the balloons before they pop or they will deposit malign mechanical toys to snare you into losing one of your four lives.

An indicator at the top of the screen shows how many balloons you need to pop before moving to the next screen difficulty level. The initial levels are easy, and can be made easier if you have some understanding of hot air.

Not only do you have to contend with balloons but a manic robot, which goes by the name of Hefty Hilda, makes life hell by sliding along the platforms, intent on crushing you and turning on all the balloon valves. A jump is in order if you want to avoid a battering by Activision's answer to Nora Batty.

All is not doom and gloom, however, as the toys can be stunned if you jump on one of the two pistons on each level while the toys are on the other. Hilda can be sprung off the screen using the same technique but she can do the same to you.

Toy Bizarre is addictive and will attract those who find **Jet Set Willy** too difficult to master. It should also prove appealing to young children, not only because of the toy factory concept but also because there are few operation keys and the plot is simple. The only danger is that they will be put off by the repetitive nature of the game.

John Gilbert

Publisher Activision **Price** £7.99
Memory 48K **Joystick** Kempston, Sinclair
★★★



more software on page 22

Dragon Torc



DABBLE in a spot of dark age magic, pitting your wits against Morag, witch queen of the north.

Dragon Torc, from Hewson Consultants, is the sequel to **Avalon**. You play Maroc who, with the help of a few spells, has to search for the five crowns of Dragon Torc.

The search takes Maroc into the Lost Vaults of Locris and from there, along ley lines, to various locations across the British Isles.

You start with three spells, Servant, Move and Bane. Other spells must be added to the list as without them nothing can be achieved. Wisps, skeletons, spiders and a flying cauliflower are just a few of the creatures you will meet and can be disposed of if you have the right spells.

Other characters who you meet may help you and the manner in which they are approached will affect their attitude towards you. Elves are particularly useful.

Maroc travels via levitation, gliding along in a lotus position. In fact Maroc is really sitting by a fire and you are guiding his astral projection.

The actions of all characters are fairly realistic. Skeletons come running with outstretched arms and snakes stop, wait and then dart forward to strike. Doors really open.

All spells, objects collected and instructions from Merlin are listed in a scrolling window at the bottom of the screen. Selection is simple — bring Maroc to a halt and press the fire button, use your joystick to select the option and press the fire button again to implement it.

Although the graphics are relatively simple, they are clearly defined and scroll in four directions. However, when Maroc is in motion, the scrolling is jerky and can be distracting.

Avalon fans will love **Dragon Torc,** which is more user friendly. The puzzles are well hidden and tricky. If you have never played **Avalon,** however, start with **Dragon Torc,** it is the better game. *Clare Edgeley*

Publisher Hewson **Price** £7.95
Memory 48K **Joystick** Sinclair, Kempston
★★★★

The Biz

I BLAME this geezer Chris Sievey. He's the one who got us into **The Biz.** Who's he, anyway? Just some cat who cut a single back in '83 with some naff ZX-81 programs on the flip side. Now he's written a Basic simulation of the pop industry for Virgin.

The first person to get a number one hit single in **The Biz** gets to appear live on stage with Sievey. Despite that, me and the lads thought we'd give it a go and formed this band called the Y Fronts.

At first we played local scout groups and the Labour Clubs. We had a dodgy manager and an agent who fixed us gigs in places we'd never heard of. Our gear got lifted regularly and eventually our drummer joined a bunch of heavy metal headbangers.

We cut our own disc and pressed 10,000 copies. Our manager fixed an interview on Radio Forth, we ligged it around the campuses and the single shot to 142 in the charts. Then the record stiffed — we hadn't pressed enough copies — and our drummer left to play with some outfit which *Sounds* were hailing as the new Beatles.

We did some local promo, got a new manager went to a hair salon and hit the London nightclubs. The band was really tight by now and the songs weren't so lousy. Stage presence was zilch, but then who's seen a C&W band with dry ice?

Then we got the break — the Factory gave us an advance and we made a new single. Capital put us on the C list and we were on standby for *Top of the Pops.* We made it to number; 42.

Then our drummer split, the gigs got cancelled, the record stiffed and the Factory tolds us where to go. We were back at square one, playing the Leeds Amnesia for peanuts. A groupie offered us some drugs, and we're not looking back now. We're not looking forward either. Tell you the truth, the colours make it difficult to look at anything at all . . . *Bill Scolding*

Publisher Virgin **Price** £6.95
Memory 48K
★★★★

Skyranger

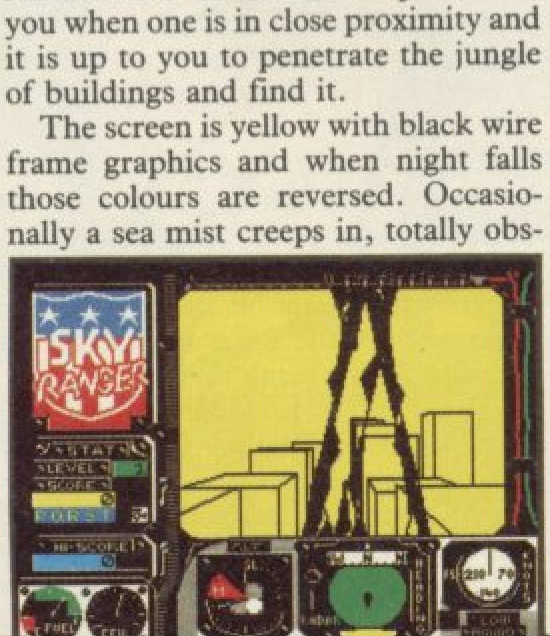
MICROSPHERE'S **Skyranger** is one of those games which looks great until you start to play it.

The idea is to fly your copter above the city to rid the skies of hostile Watchers — Drags, Trums, Rics and Dores. 10 points for guessing which micros they are named after.

The screen is impressive. As well as the view from your cockpit depicting the city's skyscrapers there is an array of instrument panels including altitude, radar and fuel.

When fuel runs out you can land at fuelling stations if you can find them. An indicator on the control panel tells you when one is in close proximity and it is up to you to penetrate the jungle of buildings and find it.

The screen is yellow with black wire frame graphics and when night falls those colours are reversed. Occasionally a sea mist creeps in, totally obscuring all graphics.



Trums, Rics and the rest of the crew are black blobs and unrecognisable. The radar will flash red when one is within target range.

If you crash or touch a building the cockpit window will crack. At the end it looks as though someone has been at the screen with a sledgehammer — which would not be at all surprising if playability is taken into account.

The music consists of annoying and inappropriate jingles, totally unsuited to this type of game. *Clare Edgeley*

Publisher Microsphere **Price** £5.95
Memory 48K **Joystick** Programmable
★★

Gyron

GYRON, a game in which brains and logic count, stands in a class of its own.

Maze games are usually easily described — but not this one. Firebird's **Gyron** is a complex game comprised of two labyrinths, one nestling in the other. Atrium is the easier game and within it is Necropolis with the wisdom of the Sorceror hidden at its centre. The idea is to reach the founts of wisdom before the sorceror can rise form the dead to claim his knowledge.

Massive balls roll in predetermined, circuitous paths through the trenches of the labyrinths. Contact with those means instant death. Rising above the walls are monolithic towers guarding the paths to Necropolis and wisdom. Each tower faces one of the four points of the compass, blocking certain routes, and each is ready to strike if you come within range.

The orientation of the towers is possibly the most important aspect of **Gyron.** Shooting the towers affects your route as each directly affects the positioning of other towers in surrounding areas. A tower may vanish when hit, sometimes only to reappear instantly later on.

The screen is viewed through the cockpit of your hedroid craft in full 3D glory. Two green lateral indicators to either side of the screen act as laser canons. As you have only a forward view of the screen, red bands descend to indicate side entrances.

SINCLAIR USER CLASSIC

A green square at the bottom of the screen indicates your position in the trench. Colliding into walls will damage the hedroid and an indicator in the control panel shows how much damage you have sustained.

A radar shows each section you are negotiating from a bird's eye view. You are always at the centre. That is an invaluable indication of where the towers are situated, the direction they are facing and also the numbers of balls rolling in that section. Another way to verify your direction is to look at the four constellations in the night sky above the labyrinth.

A timer is linked to the central computer and is synchronised to the motion of the balls. Below that is a revolving icosahedron which changes to one of 12 colours related to each section of the maze.

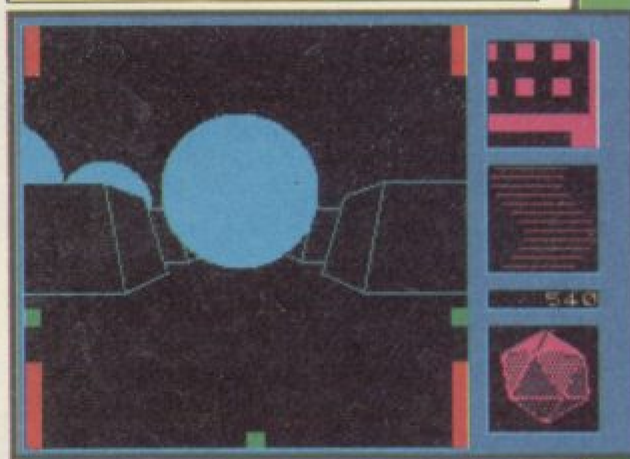
The graphics are wireframe with the balls and towers in solid blue. The balls are masked if they are rolling behind a wall. Movement is fast and smooth, and a pat on the back must go to the four programmers who took over a year to produce the game.

Firebird has produced a brilliant game combining strategy and arcade skills. A Porsche 924 motor car is on offer to the first person to discover the secrets of Necropolis.

If that isn't an incentive to buy this game, I don't know what is.

Clare Edgeley

Publisher Firebird **Price** £9.95
Memory 48K **Joystick** Kempston
★★★★★



Wizard's Lair

A FIRST reaction to **Wizard's Lair**, from Bubble Bus, is to check that **Atic Atac** has not been loaded by mistake, as the game is so obviously similar.

You play Pothole Pete who by accident stumbles across the wizard's lair and seems doomed to remain in the underground maze. Fortunately, he remembers a dreadful little rhyme he once saw on a cassette inlay which offers a clue to his escape: "If this lair thou doest uncover, four pieces of lion thou must discover. Only then may you escape past the lion that guards the gate." Sounds familiar?

Like **Atic Atac,** each room is viewed from above giving an impression of playing from the game's blueprint. There are many hostile guardians to overcome — easy enough as Pete occasionally stumbles across abandoned weapons. He also needs to keep up his energy and to that end must eat any food he discovers. Gold, diamonds and other valuable objects should also be collected as they will be needed later on.

There are several levels and those can be reached via magic lifts and wardrobe lifts. Wardrobe lifts take you straight to the next level and it is wise to note the names of those as the magic lift will ask for the name of the level you want.

A number of original features included in **Wizard's Lair** make the game more enjoyable. There is a variation in the scenery of each cavern and in some screens the vegetation border has been taken straight from **Sabre Wulf** with the same colourful jungle foliage. The speed of play is the same though certain screens in **Wizard's Lair** do take longer to draw.

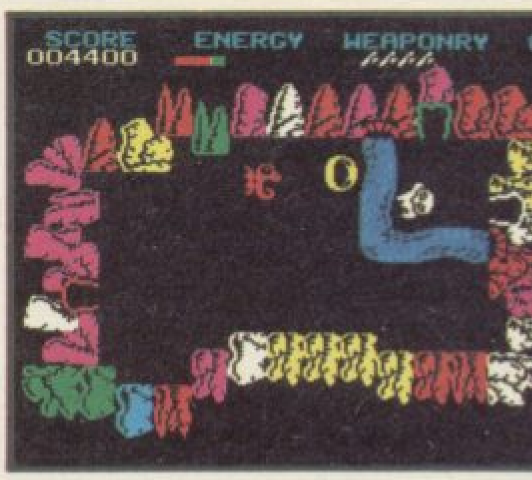
Each room has between one and four exits which open and close at random. However, in many rooms there are well hidden secret exits. One sure sign that there is such an exit is to watch from where the guardians enter.

The status display around the edge of the screen is clearly laid out. At a glance you can tell how much in the way of weapons, energy and gold you have left and objects collected.

Although the game is plagiaristic in the extreme, it is well programmed and enjoyable. The colour and graphics are as sharp and defined as **Atic Atac** and the few extra features, including a river which meanders through many screens, effectively dividing them, make the game more challenging.

Clare Edgeley

Publisher Bubble Bus **Price** £6.99
Memory 48K **Joystick** Sinclair, Kempston
★★★★



more software on page 26

CUB AND QL– THE PERFECT PARTNERSHIP



This Cub medium resolution colour monitor is TOTALLY compatible with the Sinclair QL.

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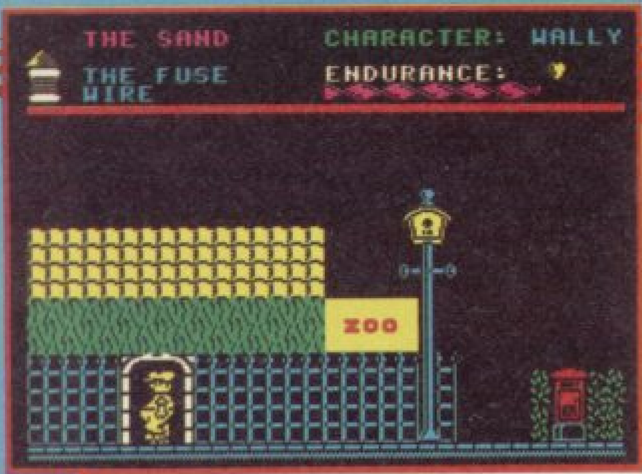
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Everyone's a Wally

EVERYONE'S a Wally continues Mikro-Gen's obsessive interest in this silly family.

Search through Wallyville for the scattered combination number of the Piggy Bank's safe in order to open it and pay the gang's wages.

Red herrings, empty oil cans, fuse wire and other objects litter the town and many are needed to perform tasks enabling you to discover yet more objects. You are required to play a few arcade-style games — found in telephone boxes — which uncover more secrets. It is an idea to note down locations of objects as each character can only carry two at a time.

Each family has a trade. You will need to make use of Wilma's shopping prowess and Dick's plumbing background. You take on the persona of each member of the gang to perform specific tasks.

It is easy to map the town and discover each location but difficult to get characters to perform functions, such as mending the fountain or building a brick wall. It is all a matter of getting the right objects to the right place with the right person.

The graphics make the game — colourful and stylishly drawn. It is a pity that the background is marred by colour overflow.

Like its predecessor, **Pyjamarama**, **Everyone's a Wally** looks good but it seems that more has gone into the graphics than the plot. For all that, it is an enjoyable game and frustratingly difficult to complete.

A dubious extra is Mike Berry's song on the reverse side — marginally less painful on the ears than the Piman's tunes. *Clare Edgeley*

Publisher Mikro-Gen **Price** £9.95
Memory 48K **Joystick** Sinclair, Kempston
★★★★

Herbert's Dummy Run

THE wally-lovers at Mikro-Gen continue their researches into suburban sub-culture with a visit to the department store in **Herbert's Dummy Run.** Herbert is the nappy-clad offspring of Wally, hero of **Pyjamarama** and **Everyone's a Wally.**

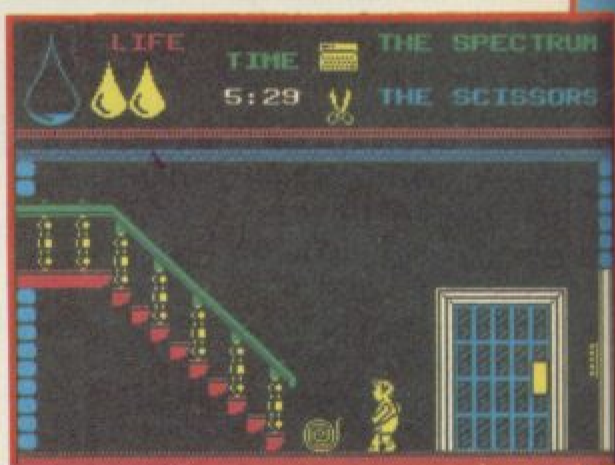
Herbert has become separated from his father, and must make his own way to the exit of an enormous department store. Being a toddler, he cannot always reach many of the objects he needs to escape without assistance, so plenty of thought and backtracking is required to complete the arcade-adventure.

Graphics are extremely colourful and pleasing, in the same style as the previous games. Colour clashes do still occur, but in general the cartoon-style decor of the store is sharp and clear. Mikro-Gen programmers seem to enjoy filling up the screen with furniture and decoration, and the department store setting suits that style very well.

Clever touches include the addition of several rooms with arcade-game sequences, satirising **Daley Thompson's Decathlon, Bomber** and **Breakout,** among others. Herbert should also proceed with care in the lift — if he forgets which floor it is at, he develops a parachute and floats down the shaft.

Although representing no great advance on the programming techniques and style of **Everyone's a Wally,** the game will nevertheless delight fans of the series and provides plenty of humour and excitement for the arcade-adventure brigade. *Chris Bourne*

Publisher Mikro-Gen **Price** £9.95
Memory 48K **Joystick** Kempston, Sinclair
★★★★



Astrocalc

WHEN the moon is in the seventh hour and Jupiter aligns with Mars, when you are tired of the animated toilets and bored with beating up Gandalf, try your hand at 'serious' astrology with **Astrocalc.**

Whether you think it's a load of moonshine or not, serious practitioners will tell you there is a lot more to astrology than meeting tall dark handsome strangers on the cartoon page of the *Daily Mail*. What puts most people off is the sheer volume of calculations to be done to construct a complete birth-chart. **Astrocalc** provides a program aimed at beginners with a booklet outlining the principles of interpretation.

You need to know the time, date and place of birth. Once those are entered, the calculations are a matter of seconds. The program produces positions for the sun, moon and planets, plus the mid-heaven and Ascendant, the sign on the eastern horizon.

The program also lists the main aspects formed between planets, with their degree of exactitude. **Astrocalc** produces suites of programs for professional astrologers with those and other features.

The accuracy of the calculations varies. Fast-moving features such as the Ascendant or moon may be as much as 1° out, but most features are accurate to about 4′ of arc.

The booklet provides an explanation of the principles behind astrology, and does explode some of the more feckless criticisms levelled against it. It is not a very readable piece, and becomes quite turgid when discussing interpretation.

Nevertheless, **Astrocalc** does provide, albeit unattractively presented, an easy introduction to the arcane secrets of the stars. Interested people should therefore be able to judge astrology's claims for themselves. As Newton once remarked to the astronomer Halley in defence of the subject, "I, sir, have studied it. You have not." *Chris Bourne*

Publisher Astrocalc **Price** £11.50
Memory 48K
★★★

Formula One

OF ALL the daydreams which never see reality, Grand Prix racing must be a favourite. There are plenty of programs for budding drivers, but few which capture the atmosphere of the season rather than the skill of driving. **Formula One** from CRL redresses the balance with a fine simulation of the sport from the team manager's point of view.

You are asked to choose a team and a sponsor, and set a level of difficulty for the game. You then get to spend the loot — Formula One cars cost vast sums of money to design, and even a million will not go far. Money can be concentrated on engine design, hiring better drivers, better crews, or chassis design. If your cars are raceworthy then it's on to the grid for the first race of a 16 race season.

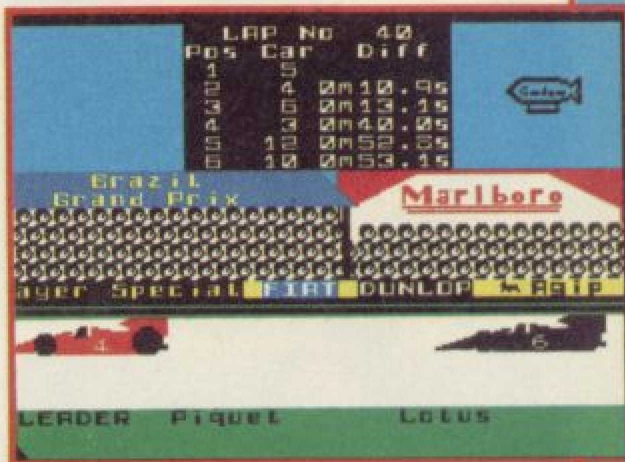
As in the grandaddy of sports simulations, **Football Manager, Formula One** shows you the highlights of the race. Unlike **Grand Prix Manager**, Silicon Joy's follow-up to their football game, **Formula One** does it very well indeed. Cars whizz past in the right order, and if you are quick you can spot the numbers — just like the real thing. A leader board constantly updates the times and positions of the first six cars, and messages at the bottom of the screen inform you of shunts, punctures, and other setbacks to individual drivers.

Pitstops are handled beautifully. You can either request them or be compelled to make them. A short arcade sequence involves sending a mechanic flying round the car changing the wheels as fast as he can. The better the crew the quicker he moves,

SINCLAIR USER CLASSIC

but you can lose precious seconds if you fail to line him up correctly.

You also have a choice of five different types of tyre and, as in the sport, you can win or lose races on the wrong choice. Weather is the factor here, and you get reports on that both before and during the race. At the end of each Grand Prix the tables are displayed for the Drivers' and Constructors' championship. Your aim is to be top of both.



As a simple game against the computer, **Formula One** would be great fun, but in fact up to six players can take part. Once you get used to the pit stop procedure, it should not be too difficult to pass the joystick around swiftly enough to avoid argument; the other operations are performed without time limit. That opens up the game to a much richer form of entertainment.

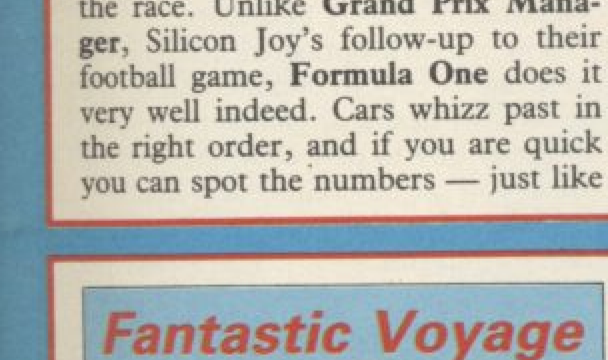
Easy enough at novice level, very tough at expert level, **Formula One** is a rare example of a simulation which combines attractive displays, good game structure and an exciting theme. Please Mr Editor, just one more go?

Chris Bourne

Publisher CRL **Price** £7.95
Memory 48K **Joystick** Kempston
★★★★★

Fantastic Voyage

FOR MANY moons now Quicksilva has been advertising a chilling program entitled **Blood and Guts** — 'A fantastic fight to the death within your own bloodstream!' The more squeamish amongst you might be relieved that the game has now been renamed **Fantastic Voyage,** after the sixties hokum pic in which Raquel Welch was injected into the body of a brain-damaged scientist — he should be so lucky.



Together with your specially designed submarine you are minaturised and implanted in the body of the boffin. Unfortunately the sub does not withstand the process and its component parts are liberally distributed throughout the anatomy.

Starting your voyage in the scientist's mouth, you have only 60 minutes in which to locate each segment of the disjointed craft and swim with it up into the brain, where it is deposited upon a mysteriously convenient ledge before final re-assembly and escape. Quicksilva is coy as to the escape route — but if the game follows the film you'll return to the outside world inside a poetic tear drop.

The ludicrous plot nevertheless makes for a tricky, entertaining and — dare one say it — educational game. Leaving the mouth with your first piece of sub, you swim down the throat, avoiding the wobbly, lethal, epiglottis (?) and into the bronchi. Turn into the right lung, being careful not to touch the pulsating sides, through the valve to the pulmonary vein, zapping the wall of yellow cholesterol, then, in quick succession, the left atrium, left ventricle, the aorta and up into the brain. Drop the part and go in search of the next piece.

Actually it's not that simple. Just when you think you're doing well, the screen flashes with the news that an infection has broken out in some distant organ, and you have to rush to the scene of the disturbance and destroy the wiggly things darting about.

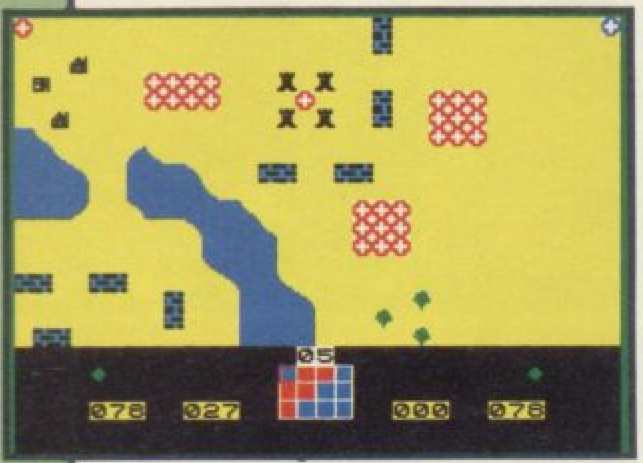
Your energy is draining all the time, and to replenish it you need to feast on any passing red cells. Without the bloody cells you fast become invisible, and play is then nigh impossible. White blood cells are useful for removing any growths you encounter.

Graphics are adequate and mercifully abstract, otherwise you might be barfing all over your keyboard. All in all, an addictive and original entertainment. In these days of clone software, what more could you ask for?

Bill Scolding

Publisher Quicksilva **Price** £6.95
Memory 48K **Joystick** Kempston, Cursor
★★★★

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Overlords

A STRATEGY wargame which takes less time to finish than a war itself? With truly simultaneous movement on both sides? And no complicated rule-book?

Well, it seems to have finally happened. Lothlorien has produced **Overlords,** a two-player game combining frenzied arcade action with deep strategy.

Loosely based on the classic board game *Campaign,* **Overlords** takes place across 12 screens of map. You have three types of piece — footsoldiers, generals, and the Overlord. You can choose different options for play — a short game, long game or all-out bloodbath.

The mechanics of the game have an original simplicity. Each player simultaneously moves a cursor around the screen to 'pick up' pieces and move them. The front lines become a mass of moving pieces as players jockey for position. The computer picks the screen for play at random, and sets a time limit on manoeuvres. The turn is punctuated by brief but vicious bursts of fire as units are destroyed.

Usually combat is decided by a straightforward count of the pieces bearing on a square, but generals have superior power and can be used to startling effect. A short game should take about half an hour. A duel to the death could last longer.

The graphics are less original, being firmly based on the UDG format with coloured tokens representing trees, buildings, castles and rivers. Whereas some wargames involve complicated movement rules for different terrain, **Overlords** simply makes such squares impassable. That means to get a piece through a forest you have to dodge the trees, thus appreciably slowing down movement.

Speed of action is remarkable, given two independent cursors on screen. But Lothlorien has gone further than that in providing a variety of facilities. You can save the game to microdrive, use joystick/keyboard combinations, and even play the game across a network of two Spectrums. Would that more companies were so thoughtful.

Chris Bourne

Publisher Lothlorien **Price** £6.95
Memory 48K **Joystick** Kempston, Sinclair, Cursor
★★★★★

Paddington's Garden Game

COLLINS Soft was first off the mark about two years ago with a series of educational programs based on Paddington.

Those early programs were fairly unremarkable and rather dull. With **Paddington's Garden Game** Collins Soft has started afresh and produced a program which is likely to be a hit with children between five and eight.

Paddington has to walk round his garden, catch butterflies and find marmalade sandwiches. He also has to avoid hedgehogs and wasps and not touch the flowers or borders.

All the ingredients of arcade action are included, several screens of action, three lives and a task, and the graphics are smooth. However the butterflies are released at the end of the game and Paddington merely gets stung.

The joystick option means that the program is easy to operate and should satisfy the desire of younger members of the family to play computer games. In doing so it reinforces hand/eye co-ordination and most of all is entertaining and fun.

Theo Wood

Publisher Collins **Price** £6.95
Memory 48K
★★★★

Moon Cresta

GOOD shoot 'em up games are difficult to find these days, mainly because most companies have booted their aliens into orbit.

Incentive, however, has only just made it back from the Mountains of Ket, and do not know about such things. The company has just brought out a passable version of **Moon Cresta.**

The game is a clone of the original arcade machine hit from Nichibutsu.

The pace and plot can be described in a few sentences, consisting mainly of two-syllable words. Take your three-stage rocket into space. Blast as many types of alien as you can. Once a phase is over, grab a bonus by docking one section of your ship with another.

For those who still do not know **Moon Cresta,** after that brief description, it is a space invaders game where the invaders are fast but dumb. They do not fire back when you loose your laser bolts on them.

Once the first stage of your ship has been destroyed the second allows you the use of two blasters instead of one. They are both needed as there is no auto-repeat and firing at aliens is a real chore, except for those who are insensitive to pain. The same is true of the joystick fire button — and we thought joysticks made it easier.

The incentive of a video cassette recorder as a prize, if you are the first person to top the 30,000 point barrier, may enamour you to the game. If you are an arcade addict your furtive fingers will waltz to the prize. As a beginner you may also throw caution and your keyboard to the wind.

If, however, you already own a video recorder, or fear for the health of your joystick, then give the aliens a rest and go out and kill a few Hobbits for a change.

John Gilbert

Publisher Incentive **Price** £6.95
Memory 48K **Joystick** Kempston
★★★

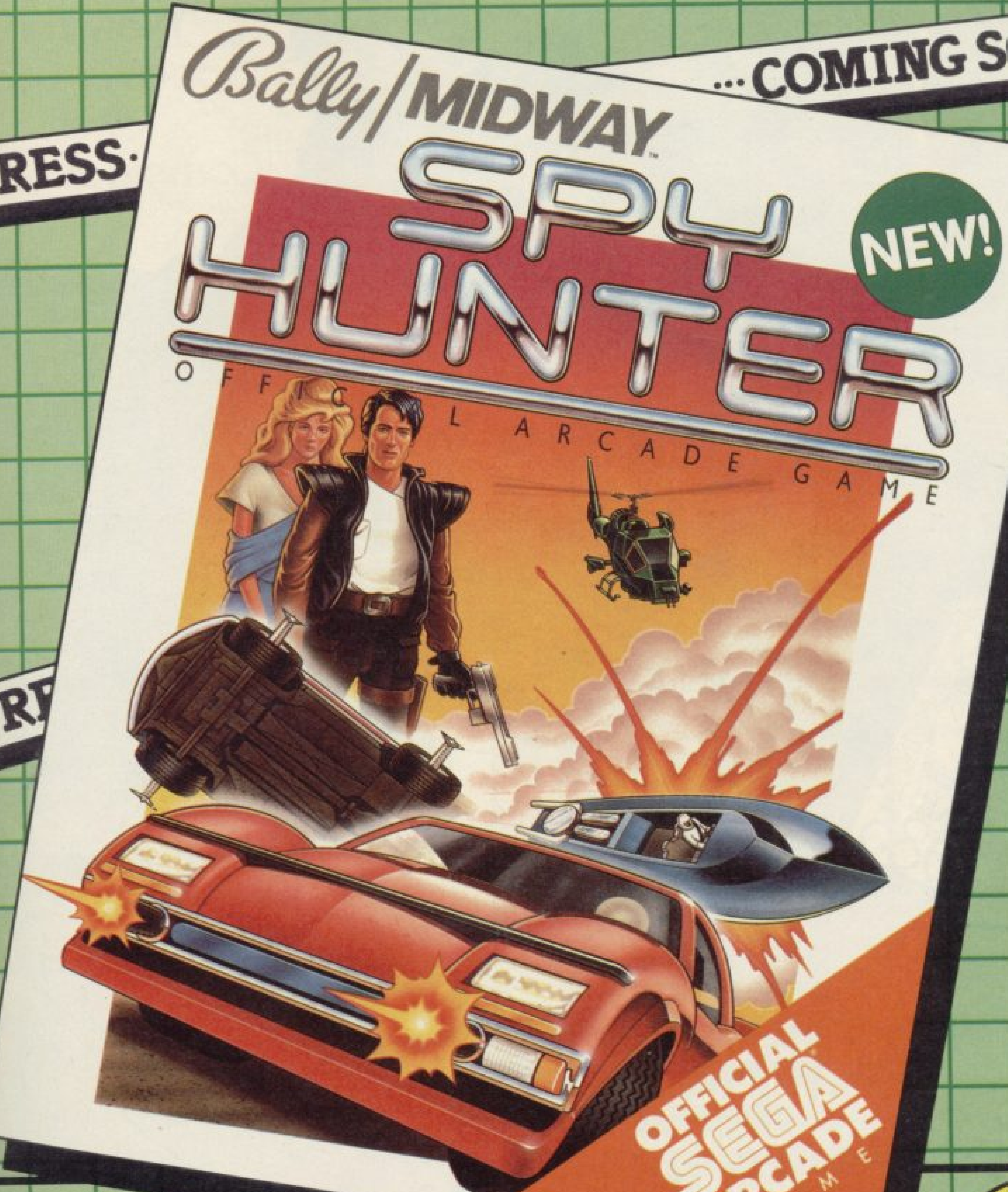


more software on page 32

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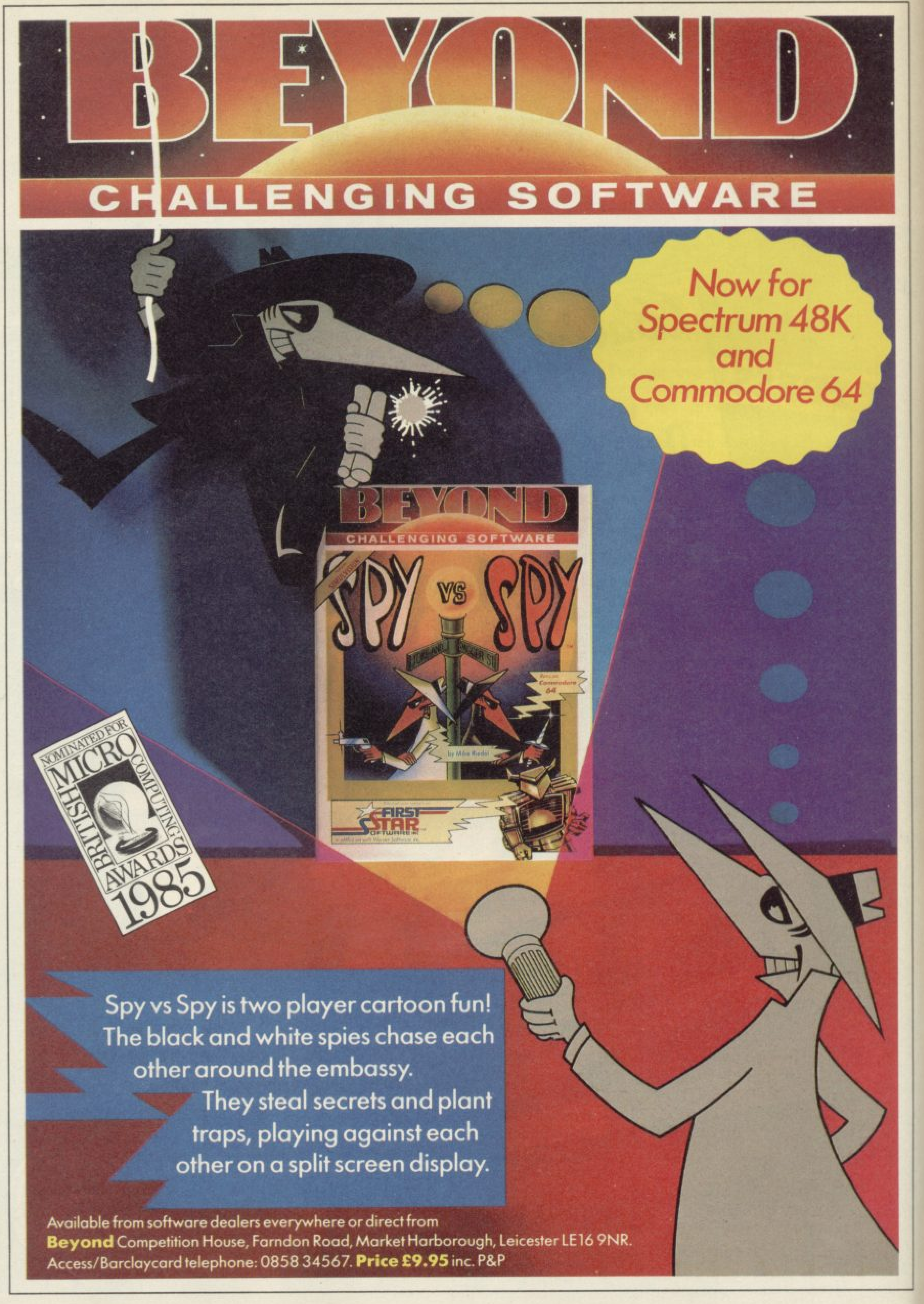
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Chaos

THE LIGHTNING powers of the black arts crackle brightly through the astral atmosphere, hurling toward their intended victim in **Chaos.**

In this new fantasy game you take on the mantle of a wizard and pit your wits against up to eight others which can either be controlled by human players or the computer.

Cast your spells of attack or protection and destroy the other mages to become a master of magic. Magic is death to all but the strongest, on the Chaos plane of Limbo.

Once you have chosen the number of wizards with which you want to do battle you can select their stance and colour. Be careful to choose one which is facing in the correct direction. Nothing dents a wizard's ego more than having to throw spells backward.

There are 50 spells within **Chaos** and you will have only a random selection of 10, some of which could be duplicates. Spells include fighting figures such as unicorns, elves and golden dragons. You can also conjure fires, castles and magic forests.

All spells are either Lawful, Chaotic or Neutral. When chaotic spells are cast players will find it more difficult to cast Lawful or Neutral spells.

The state of the magical universe is also classed as Lawful, Chaotic or Neutral. A Chaotic universe is one in which there is no order. A Lawful universe is one in which evil is punished and structure can be seen in everything.

Each spell has a chance of success. The manual gives some examples of conjurations with their success factors shown as a percentage of chance. A Giant Rat spell will be 100 percent effective but your wizardly powers will only give you a ten percent chance of conjuring a Golden Dragon.

The movement of spell creatures and your wizard character is ordered under cursor control. The number of spaces which they can be moved depends upon the spells which you have created. Wizards on foot may only move one space but if they are mounted on a spell creature they can move a maximum of six spaces.

Chaos is a fast moving and colourful game. The animation is good enough for a strategy game but the character-square graphics are simple and functional.

The game is sufficiently complex to appeal to dungeons and dragons fans and to strategy game players. So, if you've ever fancied the role of a wizard, give it a go. *John Gilbert*

Publisher Games Workshop **Price** £7.95 **Memory** 48K **Joystick** Sinclair, Kempston
★★★★

Mr T Meets His Match

MR T is back again in this *Good Housekeeping* package aimed at 4-7 year olds. There are two games on the tape, both concentrating on 'look closely!' problems.

Rainy afternoons with the youngsters could be filled with the task of beating Mr T at matching pairs. There are 12 cards which are turned over in turn, either by two children, or one child playing the computer.

There is plenty of button pushing to be done which should satisfy even the most eager of fingers. The game operates on four levels with either animals or mosaic shapes.

Switcheroo, the second game, requires a little bit of planning. At the easiest level you have to change one animal to another choosing an intermediate stage, either colour, size or animal with or without a bow tie. There are three intermediate stages to be chosen at the most difficult level.

The problem with such games is that they are so structured that they allow a child little feeling of control. Mr T could be a friendly playmate, or he could become a tyrant. *Theo Wood*

Publisher Good Housekeeping/Ebury Software **Price** £9.95 **Memory** 48K
★★★

Ski Star 2000

ONLY professional skiers need apply to race in Richard Shepherd's **Ski Star 2000** — the slalom is more like suicide than fun on the slopes.

You are given 18 options for the type of game you want to race, there are a number of courses to choose from and you can also design your own course.



If you are a coward you will go for full visibility, a gentle, uncomplicated course and no snow fall. Even with the odds stacked in your favour you will probably end up on your head.

The screen is split into three sections, a large view of the course with flags marking the route and underneath, two small screens depicting your route and a display panel with a timer and speed gauge.

The game is played in exactly the same way as a flight simulation. As you bank to go round a flag the horizon tilts accordingly and straightens up as you go for the next flag in the zig-zag course. Those who have played a flight simulation will know how difficult it is to keep the plane steady and on a straight course. It is just as difficult in **Ski Star 2000** and it is possible to turn 180 degrees and ski uphill to the start without knowing it!

The graphics are minimal with a few line drawings depicting a mountainous horizon and flags. It is a pity the game does not show the skier as that would make play more interesting. On harder races you will come across moguls scattered along the route acting as obstacles. However, the game is incredibly slow with jerky movement.

Options allow changes in speed, rate of turn, maximum roll and although those make the game marginally more interesting it is a poor substitute for the real thing. *Clare Edgeley*

Publisher Shepherd **Price** £7.95 **Memory** 48K **Joystick** Kempston, Sinclair, Protek
★★

more software on page 34

MIRRORSOFT

has had a BRAINWAVE!

Introducing new BRAINWAVES – arcade/adventure programs for the under-12's. They require quite a lot of thought and planning, so get the old grey cells working for

PHINEAS FROGG

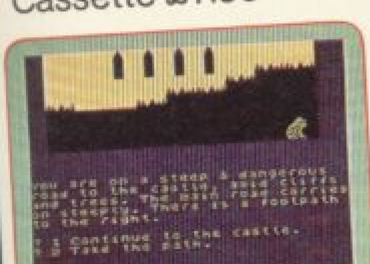
Super Sleuth

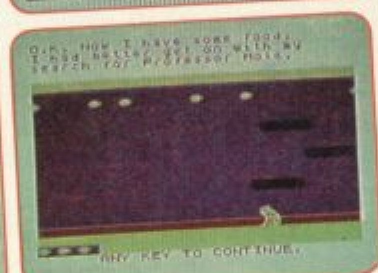
Phineas Frogg is a rather sophisticated secret agent in the tradition of James Bond (or maybe we should say James Pond, since being a frog, that's where Phineas spends a lot of his time!).

His boss, Badger, known to all as Big B, has informed Phineas that Professor Mole, the world-famous scientist, has been kid-napped and taken to the Secret Lair of the Terrible Hamsters (S.L.O.T.H.).

Your task as Phineas is to read up the background thoroughly (provided in a small book), and rescue the Professor, passing the various tests that Hamsterchief sets along the way.

Cassette £7.95 Disk 10.95

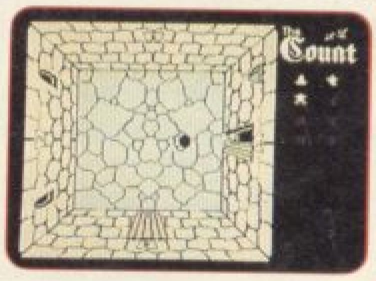
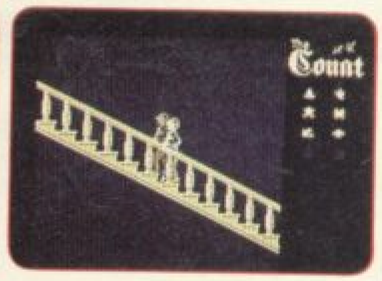


ANCIENT QUESTS

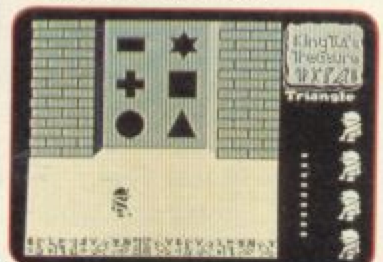
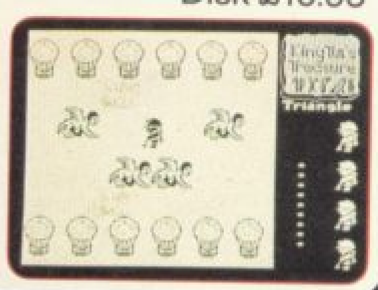
Two educational arcade action games

In KING TUT'S TREASURE, you're an archaeologist, scouring the deserts of Egypt for the keys to the famous tomb. You are equipped with a metal detector to locate buried clues but you must watch out for the hazards that appear in different parts of the desert – you only have a limited number of lives!

In THE COUNT, you are in the evil Count Dracula's Castle. You have a number of items to locate which may be found in any of the castle's dozens of rooms, and then you must escape without falling into the hands of the Count. With careful planning, you could manoeuvre the Count into a situation where sunshine will pour through the windows and turn him into a pile of dust.

Cassette £7.95 Disk £10.95

MIRRORSOFT programs are available from good software stockists everywhere. In case of difficulty or for further information, please contact:

MIRRORSOFT
MIRROR GROUP NEWSPAPERS LTD, Holborn Circus, London EC1P 1DQ
Telephone: 01-822 3580

Bruce Lee

LEAPING from the big screen to the small screen, **Bruce Lee** encourages you to practice the ancient art of Kung-Fu from the safety of an armchair.

You would think that immortality on screen would be enough, but no, Bruce wants infinite wealth as well — no doubt to keep him going in the afterlife — from a wizard who dwells beneath a temple in the Himalayas.

In this exciting game from US Gold you have to pass through three screens on ground level to a secret entrance to the caverns below. To uncover the entrance all the lanterns in those screens must be collected. Lanterns play a key part throughout the game uncovering secret entrances.

It is no simple job penetrating the wizard's stronghold. All your skills as Kung-Fu expert are called to the fore in order to defeat the evil Green Yamo and deadly Ninja — the wizard's minions.

It is worth spending a few moments before play to practice kicking and punching — very simple with joystick control — as the Yamo and Ninja will soon knock you out. The Yamo is a fat, wobbly giant but is a keen fighter and has to be knocked down three times before he collapses. The Ninja — no less deadly — needs to be knocked out only twice.

Once underground there are many traps to catch the uninitiated — exploding t'sung lin bushes and pan lights streaming across the ground are two such hazards.

Tunnels and passages have to be negotiated — watch out for electrical fields which must be dodged. Lanterns must be collected, ladders climbed and you will have to make use of a moving column of particles which change direction at random — a bit like running up a down escalator.

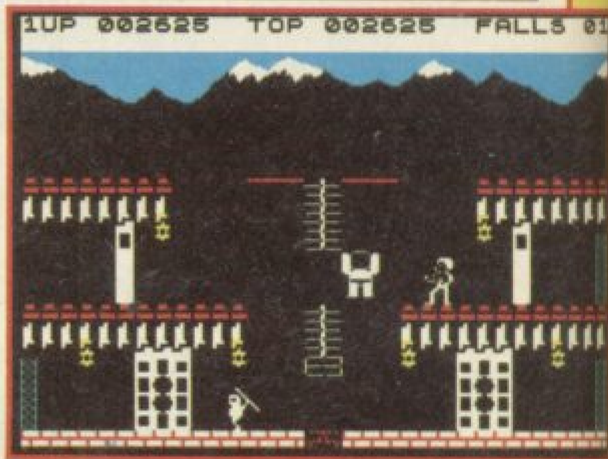
The graphics are decorative and clearly defined with good use of colour. Bruce Lee, the Ninja and Green Yamo — who incidentally is white in the Spectrum version — could be more clearly defined but are quite recognisable, and the lack of detail in their make-up doesn't detract from the game.

The options at the start are many and varied — you can play against the computer or an opponent or two players against the computer.

There is little sound and more tasks could have been incorporated. However, there are a number of tricky obstacles to avoid and 20 chambers to get through. An enjoyable game and worth buying.

Clare Edgeley

Publisher US Gold **Price** £7.95
Memory 48K **Joystick** Sinclair, Kempston, Protek
★★★★



Dinosaurs

THE Piper/Piccolo **Dinosaurs** package includes the beautifully illustrated book and is aimed at nine year olds upwards. The book is well written with short sections full of interesting facts, ideally suited for this age group.

The four programs are designed to stimulate interest in the topic. Birth of Life is an evolution simulation where you have to build at least four cells with adequate food and oxygen before they can split and evolve.

When that task has been completed you receive the code word and can go on to the second game, Life on Land. In this game you have to answer five questions before you can play the game, which is disappointing graphically and jerky in its movements.

In Mission 1 you have to recognise dinosaur shapes, and in Mission 2 control a Pterosaur as it flies over the sea to catch fish.

The concept behind the package is good, but it is a shame that the games are not particularly exciting. One or two good games on the lines of Sinclair's **Science Horizons** would have been preferable to four mediocre ones.

Theo Wood

Publisher Piper **Price** £7.95
Memory 48K
★★★



747 Flight Simulator

BET YOU never knew that if you turn a jumbo jet upside down at 20,000 feet and then cut all the engines it makes a noise like a rat with indigestion when it hits the ground.

Just one of the many features of the latest flight simulator from DACC, a company which claims to specialise in the horrid things. Don't misunderstand. Many of my best friends sit in front of the telly for hours watching the green horizon and flickering instruments while the rest of the family waits and wonders if they'll crash before the beginning of *Dynasty*.

The real trouble with Jumbo jets is there isn't a lot of scope for aerobatics and the like. Ponderous is a fairly kindly word to describe the grace and agility of the Jumbo. No doubt that is why DACC's flight simulator, in its pursuit of accuracy, is so much more boring than the faithful Psion **Flight Simulator** or Digital Integration's excellent **Fighter Pilot.**

You get the normal array of obscure instruments, the usual bewilderingly boring manual, and a landing sequence which always seems to include two or three more operations than the brain can handle at a time. Drawbacks include the lack of a screen map with your position on it, and no landmarks on the ground apart from the runways, which are themselves simply parallel lines. You'll have more fun on a cold morning at Gatwick waiting for the fog to lift.

Chris Bourne

Publisher DACC **Price** £7.95
Memory 48K **Joystick** Cursor
★★





Morag the Shapeshifter has siezed the Crown of Dumnovia and is out to find the other four crowns that make up the Kingdom of Britain. The five crowns were struck from the legendary Dragontorc of Avalon in the distant past, and if brought together again will allow the keeper fantastic power. Morag interids to control this Torc of Power and subject Saxon Britain to decades of tyranny. However, you can take the role of Maroc and Mage, seek out the remaining crowns, combat Morag and release your old tutor Merlyn from her evil spell.

On your travels through the strife torn kingdoms you can develop magical powers to help you understand and master the mysteries of landmarks like the Giant Ring of Stones, and the Secret Crypts.

The leylines, which can be plotted on the accompanying map, will be your main route to the crowns.

And for the first time in any adventure game you'll encounter Sensory Animation! This programming break-through has given lifelike emotions to the multitude of characters in the game – cross them too often and any chance you have of beating Morag to the crowns may be dashed forever.

Add to this a FREE map and scenario full of clues, hundreds of locations, all in 3D, over 200 different discoveries to make, and you have a stunning adventure it could take you a lifetime to complete!

Dragontorc of Avalon – The Living Adventure Movie – **Available for the 48K Spectrum and Spectrum +. Only £7.95.**



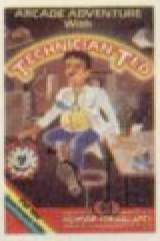
Arcade Adventure with TECHNICIAN TED

Try to work through 50 screens of varying complexity, but watch out for the most unhelpful workmates you ever came across. Remember, you are working in a factory where nothing is quite what it seems!

A unique animated loading screen with perfected collison detection plus detailed and colourful graphics has made Technician Ted one of 1985's top games.

Clock in with Ted now.

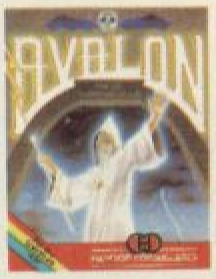
For the 48K Spectrum and Spectrum +, £5.95.
For the Amstrad CPC 464, £7.95.



GSH

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AVALON – The 3D Adventure Movie

Can you get your astral projection Maroc past the Gate House Level, through the Mines of Madness, and onwards to meet the Lord of Chaos himself?

Astounding 3D graphics over 223 rooms, 27 spells and over 100 animated characters make this the adventure game of the decade.

Can you master it sooner?

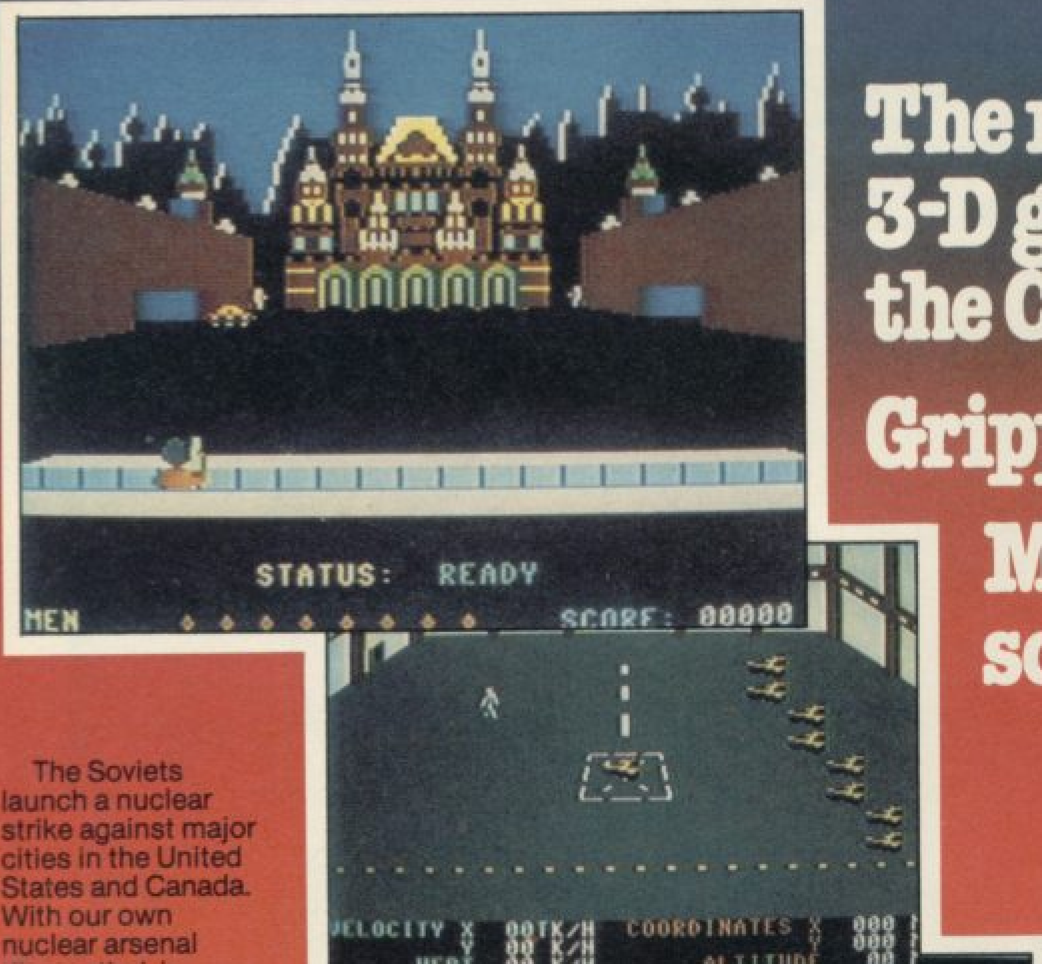
For the 48K Spectrum and Spectrum +, £7.95

As part of our continuing development of innovative software we are always happy to evaluate software sent to us with a view to publication.

YOU MARVELLED AT BEACH-HEAD...

NOW ACCESS PRESENT THEIR LATEST MASTERPIECE:

RAID OVER MOSCOW



SPECTRUM 48K

The most breathtaking 3-D graphics yet seen on the Commodore 64!

Gripping arcade action

Multiple scrolling screens

The Soviets launch a nuclear strike against major cities in the United States and Canada. With our own nuclear arsenal dismantled, in accordance with the Salt IV Arms Agreement, the Soviets believe their treachery will lead to total world domination. Our only hope is our space station equipped with stealth bombers, which can fly undetected in Soviet airspace.

As squadron leader, you must lead your commandos on a virtual suicide mission, knock out the Soviet launch sites, and then proceed into the city of Moscow. Armed with only the weapons you can carry, you must seek and destroy the Soviet defence centre to stop the attack! Top multi-screen action!



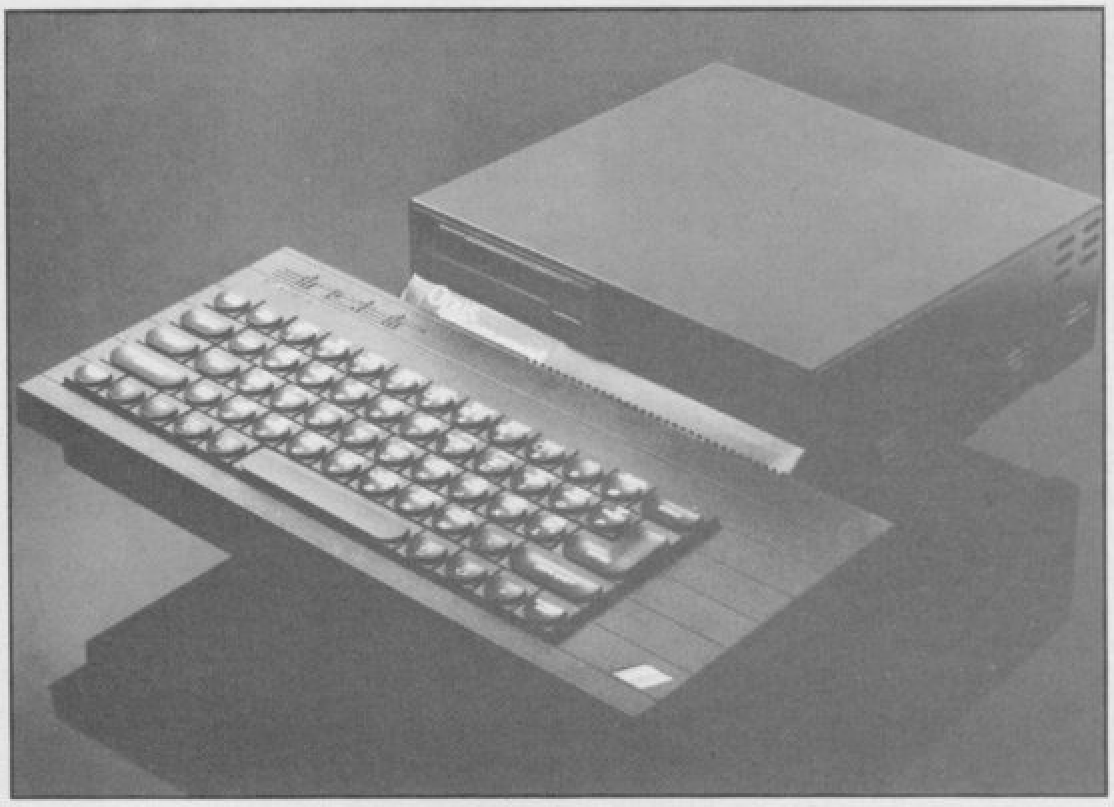
Available on CASSETTE £7·95 SPECTRUM 48K

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Dealers! For information on how to become a U.S. Gold Stockist write to: CentreSoft, Unit 10, The Parkway Industrial Centre, Heneage Street, Birmingham B7 4LY. Telephone: 021-359 3020. Telex: 337268.

John Lambert looks at a disc system which could become a standard



A voyage of Discovery

OPUS SUPPLIES has just released its Discovery disc system and it has the distinction of being the first to be supported by major software houses, endorsed by a disc manufacturer, and sold through a high street chain. It could, consequently, become the standard system.

The level of support is due to four factors. The Discovery, at is lowest level, is completely compatible in Basic with the microdrive, and many existing programs will run on it without modification. It is supplied with a drive, so software houses can sell discs and know they will fit. The unit has both a printer port – Centronics – and a joystick port – Kempston – negating the need for at least some interfaces. Lastly, it uses very little of the Spectrum memory, making program conversion easier.

Moreover, the Discovery has improved on the Interface One microdrive set up, by including random access files and the option to set aside part of the Spectrum memory as a RAM disc, which works like an ordinary disc drive but is much faster. All the Basic errors in Interface One have been corrected and the syntax can be simplified.

The Discovery range comprises three units: Discovery One, which has a single sided, 40 track, 3½in drive (178K formatted); Discovery Two, which has two drives – the maximum possible; and Discovery Plus which is the upgrade from One to Two.

Users with full-sized keyboards need not worry as the drives are high enough to clear the keyboard and those with a base similar to the Spectrum – Saga, Lo Profile and so on – fit easily.

The unit has a built-in power supply which is used to power the drives and the Spectrum, through the edge connector. That means the on/off switch can be used to reset the computer. It also has the obligatory through port and, for the serious user, a monitor socket. That is taken from the edge connector and so will work only on issue three Spectrums onwards.

All internal hardware is memory mapped within the lower 16K and so should not clash with other add-ons which tend to be I/O mapped. It is compatible with the VTX5000 modem, something about which Interface One was temperamental. Naturally, it is not compatible with Interface One.

One feature not detailed in the otherwise comprehensive manual is that, with the upgrade, a RAM chip which fits in the interface is supplied. Once fitted that allows you to alter the disc settings of the number of tracks, sectors, and sides, the interleave, skew, and even the density. By playing with those I managed to get a system which gave 196K formatted and was 25 percent faster but which used 1K sectors. The RAM disc, which normally occupies the upper 32K, can also be moved around. For dedicated hackers that will provide hours of amusement; software houses

continued on page 38

Benchmarks – all times in seconds.

	M/Drive	Disc	RAM Disc
Capacity	95K	178K	31K
FORMAT	25	18	0
SAVE	231	37	9.5
LOAD in order	15	23	5
LOAD out order	212	23	5
ERASE in order	238	35	12
ERASE out order	238	23	4.5

Program used:

```
10 FOR n=1 TO 30
20 SAVE *"m";1;"test"+STR$nCODE 30000,200
30 NEXT n
```

Filing:			
PRINT	200	59	29
INPUT in order	68	83	64
INPUT out order	199	83	64

Line 20 was changed as required and line 10 to 30 TO 1 STEP–1 for the reverse order. The filing program opened a file, printed 1000 10-character strings and closed the file 15 times. A compatable Basic program with no disc access took 23 seconds.

As microdrives do not handle random access the reverse input gives a comparable timing. The cartridge/disc was reformatted before each test to optimise performance; in normal usage a microdive cartridge uses odd blocks which effectively doubles the time taken per operation.



continued from page 37

need not worry as there are protection systems built in which, even with that information, are secure.

As with Interface One, Discovery works by using a system of channels and streams. A channel sends and receives information and a stream is the path along which it passes. For instance, the 'p' channel is the printer which usually has stream three assigned to it. With Discovery fitted a number of channels are created — 'm' for microdrive (in this case disc drive) and 't' and 'b' for the parallel port. The 't' channel is for text with options for printer width, ZX printer emulation, control of carriage returns and line feeds; 'b' is the binary channel and will accept information without modification.

The 'j' channel is for the joystick, which can be turned on and off; the 'd' channel is the drive and is used for commands which relate to the whole disc, such as backup and compact; the 'CAT' channel is the disc directory and can be treated as a file; the 'CODE' channel allows you to send information to, or from, memory.

Discovery normally uses 256 byte blocks – the RAM disc uses 32 bytes – and so when loading and saving it takes about 300 bytes. Once the disc has finished, however, that memory is reclaimed and the system takes up no memory. Interface One takes 600 bytes and does not give them back.

To be compatible with the microdrive the system will accept all its commands, using the same finger – knotting syntax; however, unless specified otherwise, the 'm' channel is assumed and can be omitted.

The few differences have been added to make the system more versatile. SAVE will automatically overwrite an existing file of the same name; the long version of MERGE – including the 'm' – will not auto-run but the short version, if not the end of a line, will; and INKEY$# returns a null string at the end of a file (the microdrive stops with an error message). Files can be specified as read or write files by adding the keywords IN and OUT.

The extra random access commands, which can be applied to any file, make ingenious use of existing Spectrum keywords. A random access file is opened using RND, the position is set with POINT and a file can be expanded using EXP. Provision has been made for End of File detection with a simple USR call.

The Discovery One costs £199.95. Compared to an Interface One and microdrive that might seem expensive, but taking into account the printer joystick and monitor ports, which would cost you around £50.00, it is a far better deal. Discovery Two is priced at £329.95, Discovery Plus at £139.95 and a printer lead at £9.95.

The Discovery range will be available from larger branches of Boots.

Further details from Opus Supplies Ltd, 158 Camberwell Road, London SE5 0EE. Tel. 01-701 8668.

Available Software

Mugsy/Sports Hero – Melbourne House
Designers Pencil – Activision
International ATC/Technician Ted – Hewson Consultants
Codename Mat/Jasper/Kentilla – Micromega
Mini Office – Database Publications.
All £14.95 a disc. To follow:
Trans Express – Romantic Robot.
Transform will be releasing versions of all its programs on disc plus a specially enhanced **Sales Ledger/Invoicing.**

Stick for tough guys

ARCADE freaks who wear out joysticks at a rate of knots and are looking for a cheap replacement should look at the new Gunshot from Vulcan. Unlike most low cost joysticks, such as the Quickshot, it uses leaf spring switches and so should last a little longer.

It has the standard features of two fire buttons, one on the stick and the other on the base, rubber suckers to hold it on the table and a moulded grip.



The feel of a joystick is a matter of personal taste. You have to move the Gunshot stick a long way before it registers and some might prefer a more delicate touch.

With the joystick Vulcan is marketing a Kempston compatible interface, priced £11.50. The Gunshot, priced £8.95, is available from high street stores.

Hold onto your Eprom

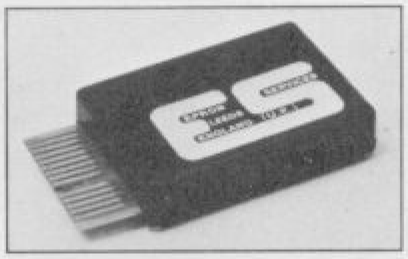
EPROM Services has brought out an Eprom holder for the QL which fits into the ROM cartridge slot. For those of you who are not into blowing your own Eproms, Eprom Services can supply a number of programs ready blown.

The advantage of programs in Eprom is that they are instantly available and unaffected by resetting the machine. The ones supplied by Eprom Services act as an extension to SuperBasic.

Utilities adds six commands. CLOCK gives a continuous display of the date and time in the top righthand corner of the screen, while TIMER shows elapsed time at the top centre. CLOCK can also be used while running the new version Psion programs if it is called before the program is booted.

The other commands are DUMP which dumps 2K of memory in Hex and ASCII to a channel; XDIR which gives an extended directory showing the length of the file and the name – microdrive only; RPT which sets the keyboard repeat and delay; and MEM. This allows you to create a file in memory, and then LOAD, SAVE or MERGE programs to and from it.

Basic+1 contains more utilities, which fall into three areas: The first group allows you to list all the



variables, procedures, functions and keywords resident in the system. The second gives you random access of microdrive files by letting you PUT and GET bytes to and from them using PTR as a pointer to the position. Lastly there is an odd collection of functions which allow you to TRACE a Basic program, RENAMe procedures, including SuperBasic keywords, find the cursor position and to convert from Hex and Binary to decimal.

Multi-tasking has a group of commands which give you control of multi-tasking jobs from Basic. You can list, start, stop or alter the priority of jobs, display the contents of the job registers or those handed to procedure from Basic, and call TRAPs directly with preloaded registers. Most useful is a SPOOL routine which takes a file from microdrive and prints it while you are doing something else. Also included is WSET which allows you to set up a window using the cursor keys.

The price of the holder is £14.95 or £24.95 with one program, £29.95 with two and £34.95 for all three – remarkable value. The forthcoming programs are expected to be around £9.95 each – plus holder if necessary.

If you would rather use your own programs in Eprom the holder has two sockets which can accept Eproms of up to 8K.

Further details of this, and other QL products, can be obtained from Eprom Services, 3 Wedgewood Drive, Leeds LS8 1EF.

Re-usable grid sheets

ORION has released a reusable graphics kit which is extremely simple. The Format 4 kit – the SP42 – has four plastic sheets with different sized grids and two water-soluble pens. Once you have perfected one design you simply wipe the plastic with a damp cloth and start on the next one.

The grids are two full-screen grids showing print positions, pixel positions, screen and attribute file addresses, a larger scale quarter screen and one with six, 4×4, enlarged character squares for UDGs. Also included is a pixel ruler.

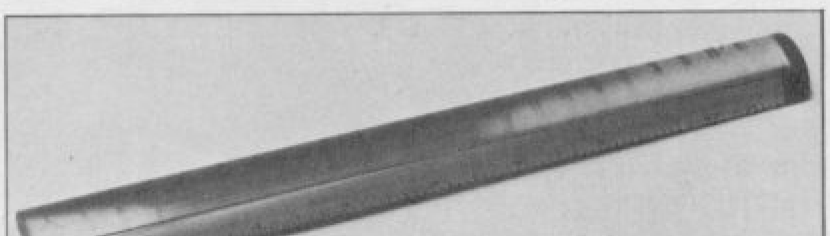
It is available from Orion Software Products, Pippbrook Mill, Dorking, Surrey, priced £5.99, or the educational suppliers Griffin and George.

more hardware on page 40

Ruler of the galaxy

HAD Arthur Dent been at the launch of the *Heart of Gold* he might well have mistaken the Hooloovoo for a Mega Rule.

The error would have been a natural one. A Mega Rule is a clear perspex ruler, with a hint of blue, which magnifies the text beneath it.



If Arthur had been in the habit of entering listings from magazines, rather than hitch-hiking round the galaxy, he would have found it just right for helping him to read that miniscule printing and keep his place at the same time.

Mind you, he would have had to write to Dealer Deals Ltd at 20 Orange Street, London WC2H 7ED, with £2.99. If he had wanted to telephone he could have called 01-930 1612.

An ideal present for intelligent computer users everywhere . . . and to all those out there with an Acorn, the secret is to bang the rocks together, guys.

Monitoring the design

THIS month we look at two monitors from Citadel Products, the 101QL and Multitech MVM12G, both 12in, green screen models.

The 101QL is the cheaper at £79.93 including VAT with a simple black and white plastic case. The only user control is an on/off/ brightness switch under the carrying handle on the top.

It is to be hoped that you will never have to adjust the picture size or position as those thumb wheel controls can only be reached with the back of the monitor casing removed and the tube exposed.

The socket into which the video lead plugs is of the 'bnc' type which is rarely used on home computers. A special lead can be supplied for £5.95.

The MVM12G is a very professional looking monitor priced at £102.93 including VAT. It has a matt grey housing and is supplied with a swivel/tilt stand. On the front is a brightness control and power-on light.

At the back are the usual adjustment controls, and the video socket. There is also a video out socket, plus mode switch, to allow a number of monitors to be chained together.



Both monitors were tested on the Spectrum and QL. On the Spectrum both displayed a series of bright white lines across the top of the picture and the MVM12G suffered excessive shimmering.

On the QL the picture was better, the MVM12G still shimmered but had quite good definition and gave a bright picture. The 101QL gave the best picture with negligible shimmer, but with a black screen a moving band of bars was noticeable on the lefthand side. The picture was also dull, which on the Psion programs made parts of the Prompts window difficult to read.

The 101QL is reasonable on the QL and adequate on the Spectrum and seems the better buy of the two.

For further details contact Citadel Products Ltd, 50 High Street, Edgware, Middlesex HA8 7EP. Tel: 01 951 1848.

Sticks to the QL

A JOYSTICK on the QL is a useful addition. Dedicated joysticks fit directly into the CTRL port, and standard joysticks use an adaptor lead.

The joystick from Eidersoft is a standard Quickshot II with a QL-type lead. It costs £11.95, or if bought with the **QL Art** program, £9.56. Contact Eidersoft, PO Box 54, Ilford, Essex IG1 1BR. Tel 01 478 1291.

A cheaper alternative, if you already have a joystick, is an adaptor lead. One can be obtained, priced £4.95, from CLPS Ltd, Shire Hall, The Sands, Appleby-in-Westmorland, Cumbria CA16 6XN. Tel 0930 52204.

Talking to printers

DOWNSWAY Electronics has released an RS232 to Centronics converter for the QL. Unlike many of the other converters on the market it has a switchable baud rate, the default of 9600, and 19200 for fast printers.

It is the cheapest so far at £31.95. Downsway Electronics (UK) Ltd, is at Depot Road, Epsom, Surrey KT17 4RJ. Tel 03727 27222.

Look, no interface

MONITORS are popular if Sinclair Surgery is anything to go by. Both the Spectrum — issue three onwards — and the QL are capable of driving a composite video monitor without the need for an extra interface, but both require a special lead.

Transform supply one for the Spectrum. It costs £11.50 from Transform Ltd, Swatlands, Lucks Lane, Paddock Wood, Kent TN12 6QL. Tel: 089 283 4783.

CLPS produces QL leads, which can have a phono or aerial plug to the monitor. Both are priced £2.50 inc, from CLPS Ltd, address elsewhere on this page.

Mono turns up trumps

AS programs such as Tasword Two require good definition to give more than 32 characters across the screen, many users are turning to black and white monitors for a readable display. A special interface is not required for such monitors and they are a low cost alternative to RGB for the QL.



The Boxer 12 from Hantrex is a 12in high resolution, green screen, composite video monitor designed for the home computer user.

The usual controls – brightness, contrast, on/off – are on the front, while others, such as picture size and position, are hidden under a flap, also on the front. It has an attractive silver grey casing.

The Boxer 12 costs £99.95 from Hantrex (UK) Ltd, Unit 2, Lower Sydenham Trading Estate, Kangley Bridge Road, London SE26 5BA. Tel: 01-778 1414.



This state of the art range of Quick Disks is the real alternative to tape filing systems without the high costs of the floppy disk system –

Crescent £99.95 Quick Disk

The low cost alternative to the Spectrum Micro Drive with better media.

All units have Japanese mechanisms and are manufactured by Servicon Dynamics, a company with over 15 years of success in specialist electronic manufacturing. All items carry a 12 month warranty.

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*The Crescent 128 is a drive unit only and designed as an expansion unit for disk copying and advanced programming. The Crescent 128 interfaces with the Crescent 128i to give the increased capacity of the Crescent 256i.

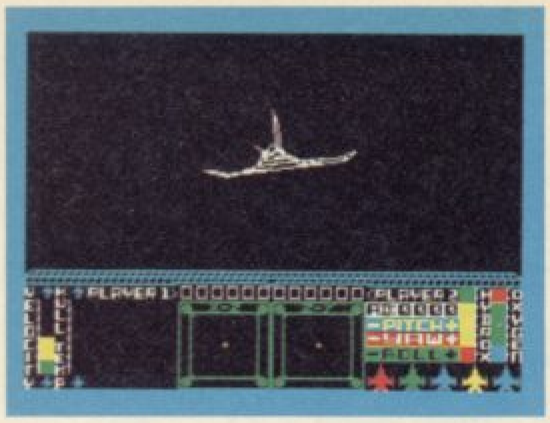
Servicon Dynamics Limited,
Brook Street, Mitcheldean, Gloucestershire, GL17 0SL
Tel: 0594 542021 Telex: 43586 SERDYN G. Dept. S

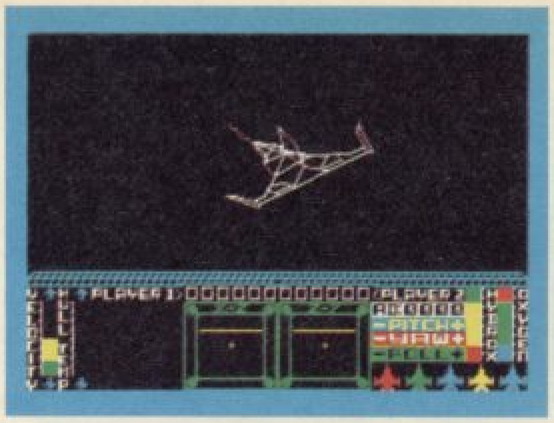
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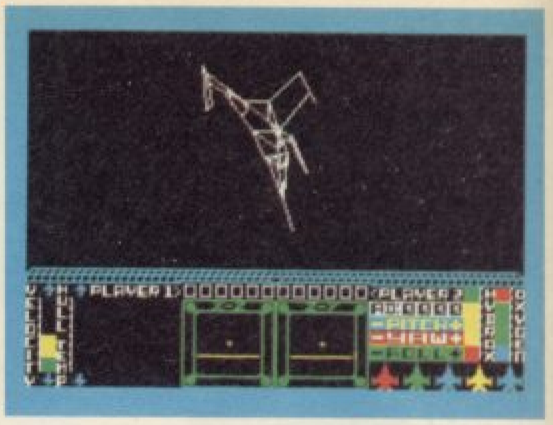
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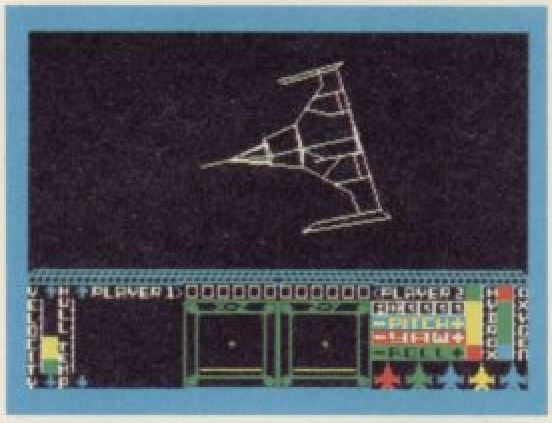
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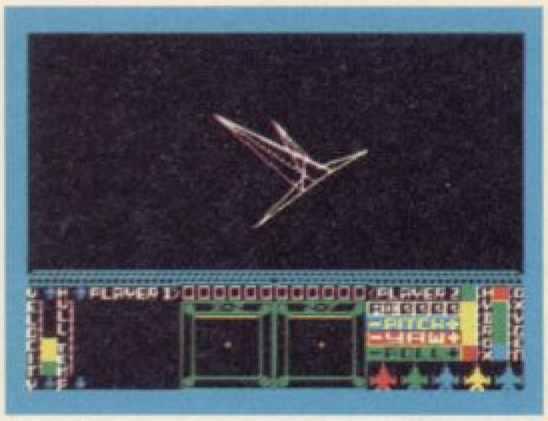


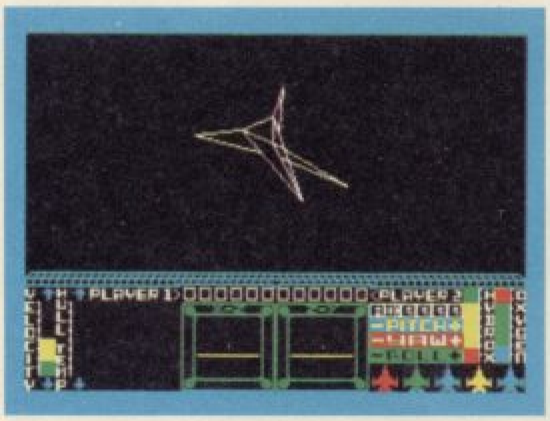


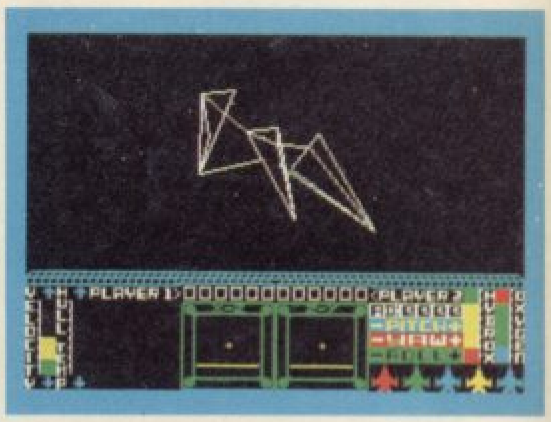
243 time states

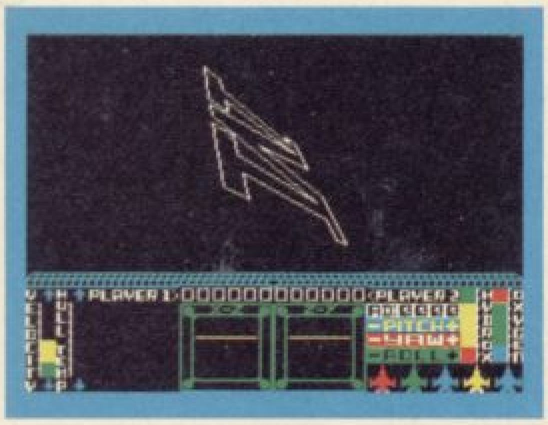


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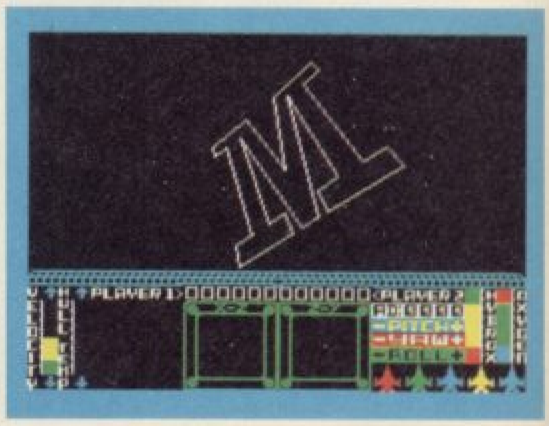








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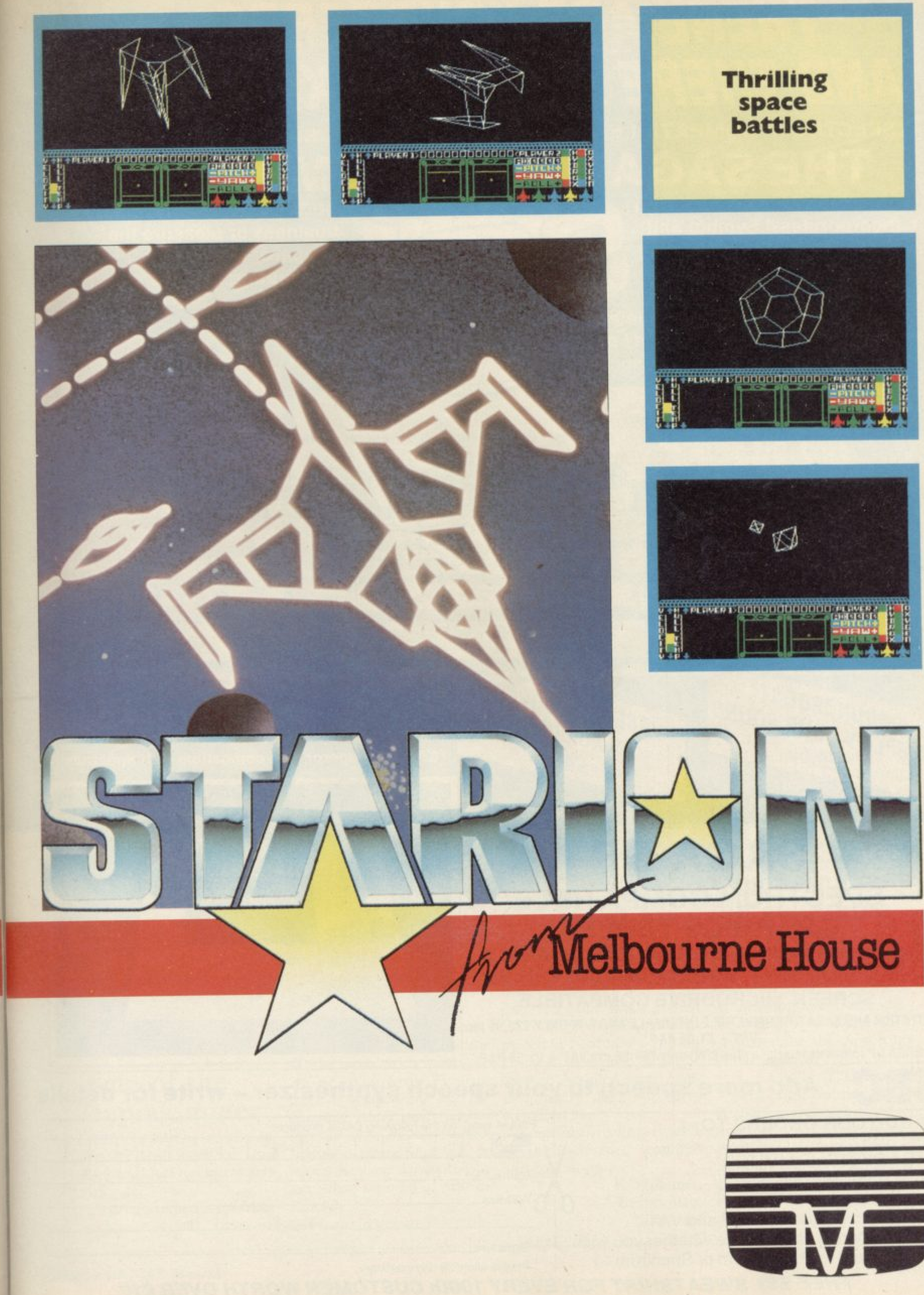
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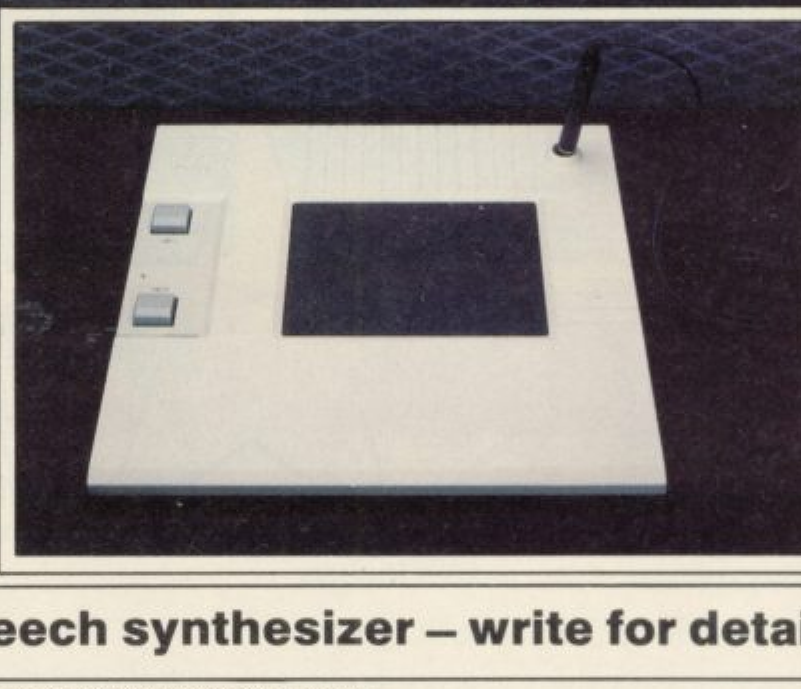
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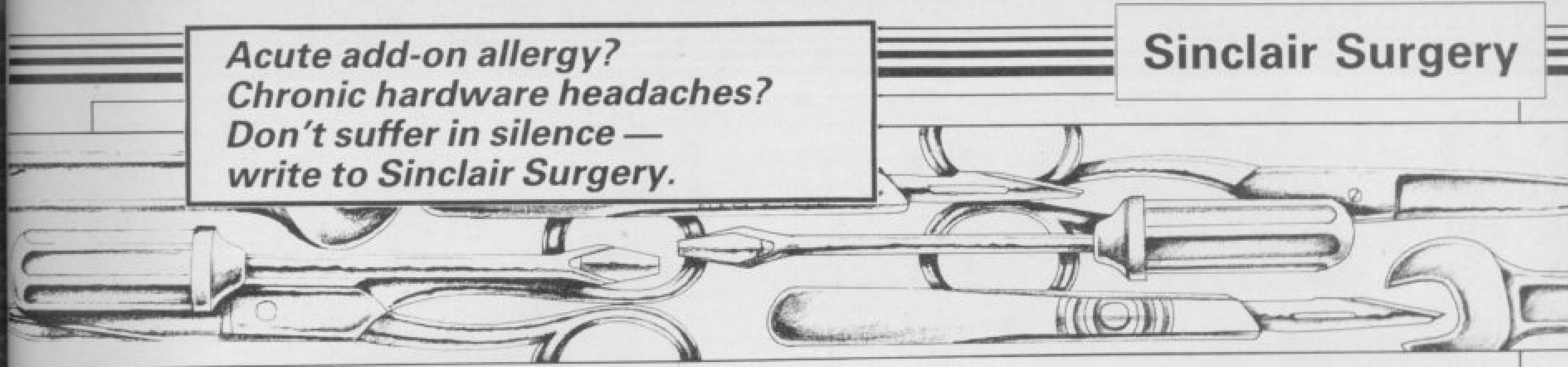
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Micro rejects printer

IN YOUR December 1984 issue you printed details on how to connect the Interface 1 to an OK1 Microline 82A dot matrix printer using the RS232 port. On connecting the computer to printer I am only able to use the LLIST command; COPY and LPRINT do not work.

Alex Kachellek, Chinnor, Oxfordshire

● *Both LLIST and LPRINT send information to the printer via a pointer held in the channel information area. By changing that pointer full-sized printer interfaces, and Interface 1, can redirect output from those commands. COPY is implemented by a direct call to the ROM and can not be redirected; this is because different printers require different software to copy the screen.*

As LLIST and COPY seem to work as they should, the problem is LPRINT. LPRINT is the same as PRINT #3. One possible solution would be to use a different stream. Try entering the following program:

```
10 OPEN #4; "t"
20 PRINT #4; "Anything"
30 CLOSE #4
```

If that does not work then there is a fault with either the Spectrum or Interface 1 and they will have to be repaired.

Tale of the leaping miner

I HAVE purchased the Interstate Pro interface from Bud and the Quickshot joystick.

I programmed it for **Manic Miner** — left, right and jump. On the leaflet it states: "please note that the fire button takes priority over all other selections and will operate in ANY position." Therefore if you moved the joystick to the right and at the same time pressed the fire button — jump — Willy should jump to the right — in theory.

Did it do that? No! Willy jumped straight up into the air. I had many a go at this but each time the same thing happened. On all games if I accidently moved the joystick into a position I had not programmed to do anything the whole game would stop dead until I let go of the joystick.

After spending over £30 I am quite disappointed.

Jason Austin, Royston, Hertfordshire

● *The answer to the Manic Miner problem is to program 'jump' as 'up' on the joystick.*

ZX-81 out of control

I HAVE been given a ZX-81. I had it set up and working but on loading a game and when playing — the TV screen seems to jump a lot and rolls up. It cannot be controlled with the vertical hold.

Where — if at all — can I buy ZX-81 games. I can't find any in Croydon.

Mrs D Williams, Croydon

● *The problem is with the ZX-81. A different TV may solve it temporarily but the computer really needs repairing. It may be worthwhile finding a secondhand '81, or even a new one as some shops are selling them for as little as £20.00.*

Finding software is a problem. Keep an eye on the adverts in Sinclair User, *particularly those from Software Farm, or you could try the Buffer Micro shop in Streatham.*

Micro learns to speak

I AM planning to purchase a speech unit for my 16K ZX-81. I have already considered a Cheetah speech unit, but do you recommend any others on the market?

Secondly, I wish to teach myself the art of programming Z80 machine code, for which I would need a book.

D Green, York

● *The majority of speech units use the same chip and so there is little to choose between them. The William Stuart Systems range may be of interest. The address is Quarley Down House, Cholderton, near Salisbury, Wiltshire SP4 0DZ. Tel. 098 064 235.*

The best book is Mastering Machine Code on Your ZX-81 *by Toni Baker, from Interface Publications, 9-11 Kensington High Street, London W8 5NP.*

Confused by data line

I HAVE a 48K Spectrum. I noticed inside that it is an issue 3B, but when I tried PRINT IN 65278, as suggested in February's *Sinclair User*, in a repeat loop the answer scrolled was predominantly 255, but occasionally 191.

I am also having trouble keying asterisks, commas and full stops.

K Williams, Bridgwater, Somerset

● *The main difference between issue 3 and issues 1 and 2, as far as software is concerned, is that data line D6 which previously was held high is now left to float. What that means is that it used to be kept at logic level 1 but now can be either 1 or 0. To see that print BIN 10111111, which gives 191, and then change bit 6, counting from the right, to 1, i.e. print BIN 11111111, which gives 255.*

As for your keyboard, perhaps you should have it repaired. Technicon Services, Bristol. Tel 093484 3460.

Earthing cures dot crawl

WITH REFERENCE to Mr Duggan's letter on dot crawl in your February issue. I found little improvement by tuning VC1 as you suggested, but a good earth link from the mains lead earth-pin to the outer of the TV co-axial lead completely cured the problem.

G M Paterson, Putnoe, Bedfordshire

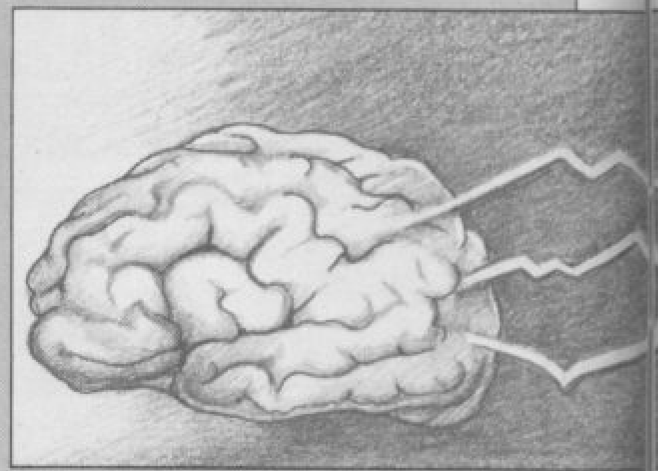
Upgrading and the guarantee

I HAVE just read that the Spectrum 48K is to be discontinued. As I have a two year extended guarantee, will it invalidate my guarantee if I send it away to be upgraded to the Spectrum Plus.

T D Brook, March, Cambridgeshire

● *Sinclair Research has confirmed that upgrading will not invalidate its own one year warranty but you will have to check with the shop where you bought the Spectrum as to any additional guarantee.*

Learning the secret of mind over machine



Bored with Basic? Curious about code? Our new series introduces you to the mysterious language of the Z80. Marcus Jeffreys is your interpreter

ONCE proficient with Spectrum Basic, many users turn to Z80 machine code as the next language to learn, usually to increase speed and decrease program size.

It is all very well spending hours mapping out new arcade games, but not very useful if they are either too big to fit into memory or too slow to be playable. Unfortunately, Z80 is very different from Basic, and the majority soon become disillusioned with the language. However, with just a little perseverence, Z80 can easily be mastered.

In this series of articles, we hope to teach the main aspects of Z80 machine code. Do not expect to be able to program the world's greatest game immediately, but each article will include an example program, using the techniques learnt, which you will be able to incorporate into your own programs to speed them up.

Z80 programs are usually found in two forms: assembly code and machine code. When writing in machine code all instructions are stored as one or two numbers in the range 0 to 255. That, however, is not very convenient for the machine code programmer, so assembly language uses a program in the computer to convert three- or four-letter codes into the machine code numbers. A few of those codes can be seen in figure four — LD, INC and DEC — and to the right of those are their numerical equivalents.

Hex	Decimal
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
A	10
B	11
C	12
D	13
E	14
F	15

Figure 1. Hexadecimal — decimal conversion

You'll have noticed that some of those numbers include the letters A to F as well as the digits 0 to 9. That is because the numbers are shown in hexadecimal form — hex — which uses base 16. Figure one shows how those digits are related to the normal decimal system — base 10. To convert a hex number to decimal, carry out the following operations:

Take a pair of hex digits — for instance, B1. Look up the first digit in figure one, and multiply its decimal equivalent by 16. So, B (in hex) is 11 (decimal) and

11 × 16 = 176

Add the decimal equivalent of the second hex digit. Thus,

176 + 1 = 177

to give the answer.

The reverse operation can be carried out by dividing a decimal number by 16 to give the first hex digit, and using the remainder for the second hex digit.

Basic programmers are used to having a fairly sophisticated language with a large number of variables. When using machine code, there are only a limited number of variables, known as 'registers'.

The main Z80 register is the A register, also known as the accumulator. That is eight binary digits — bits — long, so it can only hold a number in the range 0 to 255. Eight bits is known as one byte of information when using the Z80 processor. It is for that reason that hex numbers usually consist of two hex-digits, since that will represent a number in the range 0 to 255.

The Z80 processor has a number of other registers, the most important of which are the ones labelled B, C, D, E, F, H and L, all of which are one byte long, as with the accumulator.

Your Spectrum has either 16K or 48K of memory. K stands for kilobyte, meaning 1000 bytes. In fact, a kilobyte normally refers to 1024 bytes, because that is the maximum range which can be stored as 10 bits of information. A 48K Spectrum has, in fact, 64K of memory, but 16K of that is ROM — Read Only Memory — and is used to instruct the computer what to do when you type in commands and run Basic programs.

Now, 64K is the range 0 to 65535, which is exactly the range of a number containing 16 bits of information. That is two bytes, and usually represented as a sequence of four hex digits. Consequently, all instructions which alter a particular byte in memory must use four hex digits to specify which byte is to be changed.

We are now in a position to understand a simple machine code instruction:

```
LD A , (6000h)
```

That is shown in assembly language, but could just as easily be shown in machine code hex numbers:

```
3A 00 60
```

The English translation of that would be "Load (LD) the accumulator (A) with the contents of the hex location 6000 (6000h)". The 'h' at the end of the number means the number is in hex form. The brackets surrounding the number specify that we are interested in the contents of location 6000h, not the number itself. Thus the instruction:

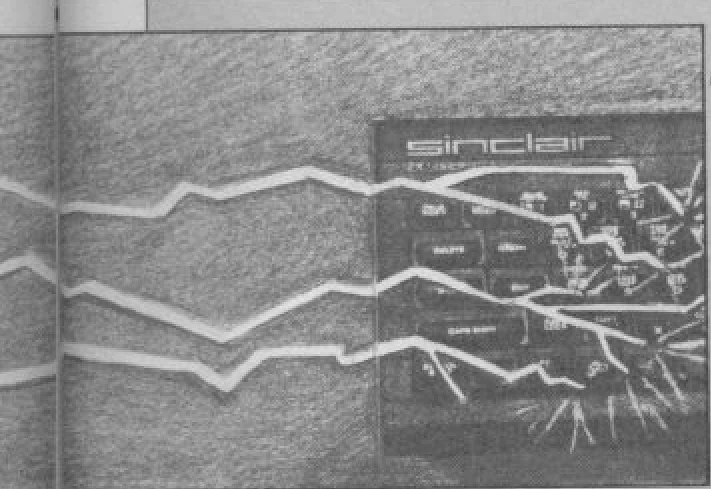
```
LD A , 1Fh
```

would load the number 1Fh (that is, 31) into the accumulator, but

```
LD A , (1Fh)
```

would instead load the contents of the 31st byte of memory into the accumulator.

We already know that the registers can only hold numbers in the range 0 to 255, and that memory locations — addresses — are in the range 0 to 65535. That is most inconvenient, but



we can fortunately combine some of the registers together to give the correct range. The registers are paired as B + C, D + E and H + L. So, the two instructions

LD HL , 6000h
LD A , (HL)

would be exactly the same as our first instruction. The number 6000h is loaded into the combined H and L registers, so that the accumulator is then loaded from the contents of address 6000h.

The difficulty with learning machine code is that it is easy enough to learn the instructions, but knowing what to do with them can be quite a problem. So we will look now at a typical application using some of the instructions we have already learnt. This short machine code routine can then be easily incorporated into your own programs.

First of all, type in and run the Basic program in figure two. The

```
  30 CLS
  40 FOR i=1 TO 704
  50 PRINT CHR$ (25*RND+65);
  60 NEXT i
  70 INPUT "Attribute value = ":
att
  90 GO SUB 5000
 100 GO TO 70
 110:
 120:
5000 REM Fill attribute screen
5010 FOR h=22528 TO 22528+767
5020 POKE h,att
5030 NEXT h
5040 RETURN
```

Figure 2. Basic colour change

program will fill the screen with random characters, then prompt you for a number. By entering numbers in the range 0 to 255, you can alter the foreground, background, brightness and flashing of the characters on the screen. You can form a number for a specific colour combination as follows.

Take a number from figure three for the foreground colour. Take another number for the background colour, multiply that figure by eight, and add it to the foreground colour number. Then add 64 if your want the

Number	Colour
0	black
1	blue
2	red
3	magenta (blue + red)
4	green
5	cyan (blue + green)
6	yellow (red + green)
7	white (blue + red + green)

Figure 3. Spectrum colours

character to have brightness turned on. Add 128 if you want the character to be flashing.

Each character cell on the screen has an attribute value, as given above, to define its colour. All attribute values are held in memory, starting at location 22528. Consequently, the Basic program has a loop which fills those values with the number you type in. Unfortunately, you will notice that it takes quite a while to change the screen colour. What we really need is a routine which works almost instantaneously. The assembly code for such a routine is given in figure four.

the number 768 into the BC register pair — that is the number of locations which have to be changed. The next instruction is a little different, because we have used brackets. That will load the contents of location 60000 into the combined DE register pair. Now each register can hold a byte of information, so register E is loaded with the byte at location 60000, and register D is loaded with the next byte at location 60001.

In fact, the only byte we are interested in is the one we put into the E register — that will be the number to which all the attributes will be changed. Nevertheless, we have to use the double register instruction, because Z80 doesn't have the instruction

LD E , (60000)

All the load instructions are given in figure six, and we'll look at those in a moment.

On each execution of the main loop of the program, the number in the E

```
                 : Place the code E into all attribute locations

                        ORG     60002           :Code starts at
                        LOAD    60002           ;location 60002

EA62 210058     COLOUR  LD      HL,22528        ;HL = Start of attribute file
EA65 010003             LD      BC,768          ;BC =Number of screen positions
EA68 ED5B60EA           LD      DE,(60000)      ;E  = Contents of 60000
                                                ;   = Value of new attribute byte
EA6C 73         LOOP    LD      (HL),E          ;Place attribute byte into file area
EA6D 23                 INC     HL              ;HL = Next byte in file area
EA6E 0B                 DEC     BC              ;Count the changed locations
EA6F 78                 LD      A,B
EA70 B1                 OR      C               ;Jump to the lable LOOP if BC is
EA71 20F9               JR NZ,  LOOP            ;still greater than zero
EA73 C9                 RET                     ;Return to the BASIC program
                        END
```

Figure 4. Assembly code colour change

The first instruction in the listing,

LD HL , 22528

loads the first location of the attribute area into the double HL register pair. Remember, the actual value 22528 is used, because we have not used any brackets.

The instruction which follows loads register is placed into the contents of the location in the HL register pair. That is the instruction

LD (HL), E

The first time that is executed, it will place a number into the location 22528 — the first byte of the attribute area

continued on page 48

```
  10 CLEAR 59999
  20 GO SUB 1000
  30 CLS
  40 FOR i=1 TO 704
  50 PRINT CHR$ (25*RND+65);
  60 NEXT i
  70 INPUT "Attribute value = ":
att
  80 POKE start,att
  90 RANDOMIZE USR 60002
 100 GO TO 70
 110:
 120:
1000 REM HEX CODE LOAD ROUTINE
1010 DEF FN p(x)=CODE h$(x)-48-7
*(CODE h$(x)>=65)
1020 LET byte=0
1030 RESTORE 2000
1040 READ start
1050 READ h$
1060 IF h$="*" THEN  GO TO 1160
1070 IF LEN h$<>2*INT (LEN h$/2)
 THEN  PRINT "Odd number of hex
digits in: ";h$: STOP
1080 FOR i=1 TO LEN h$
1090 IF NOT ((h$(i)>="0" AND h$(
i)<="9") OR (h$(i)>="A" AND h$(i
)<="F")) THEN  PRINT "Illegal he
x digit: ";h$(i): STOP
1100 NEXT i
1110 FOR i=1 TO LEN h$ STEP 2
1120 POKE start+byte,16*FN p(i)+
FN p(i+1)
1130 LET byte=byte+1
1140 NEXT i
1150 GO TO 1050
1160 PRINT "Code entered"
1170 PAUSE 150
1180 RETURN
2000 DATA 60000,"0000"
2010 DATA "210058","010003"
2020 DATA "ED5B60EA","73","23"
2030 DATA "0B","78","B1"
2040 DATA "20F9","C9","*"
```

Figure 5. Hex loader and colour change routine data.

continued from page 47

— and will colour the top left hand character on the screen. On subsequent loops, the HL register pair will be updated using

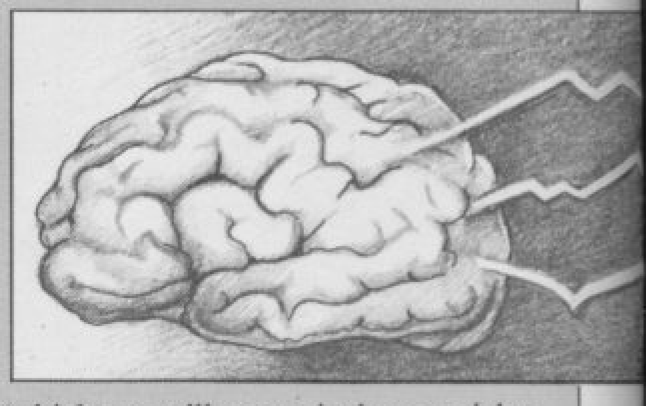
INCrement HL

so that all characters on the screen are coloured. The last few instructions decide when to stop and the RETurn instruction passes control back to the main Basic program.

To implement this machine code routine, type in and run the Basic program given in figure five. Type in a few numbers — range 0 to 255 — when prompted, and you will see how quickly the screen colour changes.

Looking closely at the data statements from line 2000 onwards, you will notice that the strings match the hex numbers in the assembly code listing. Those are decoded and placed into memory, starting at location 60000 — the first data item — by the hex loader routine — lines 1000 to 1180. It would be a good idea to save this to tape, because it will be used again in future articles

Most of the load instructions supported in Z80 machine code are given in figure six. The ones not given concern other parts of machine code



which we will cover in later articles. When using these, 'addr' stands for a two-byte location number (eg 60000); 'A' stands for the accumulator; 'rp' stands for register pair (BC, DE or HL); 'reg' stands for register (A,B,C,D,E,H or L); 'byte' is any number in range 0 to 255; 'word' is any number in the range 0 to 65535 (two-bytes).

So, for example, the instruction

LD HL , 22528

used in our colour program is an example of a load instruction of the type

LD rp , word

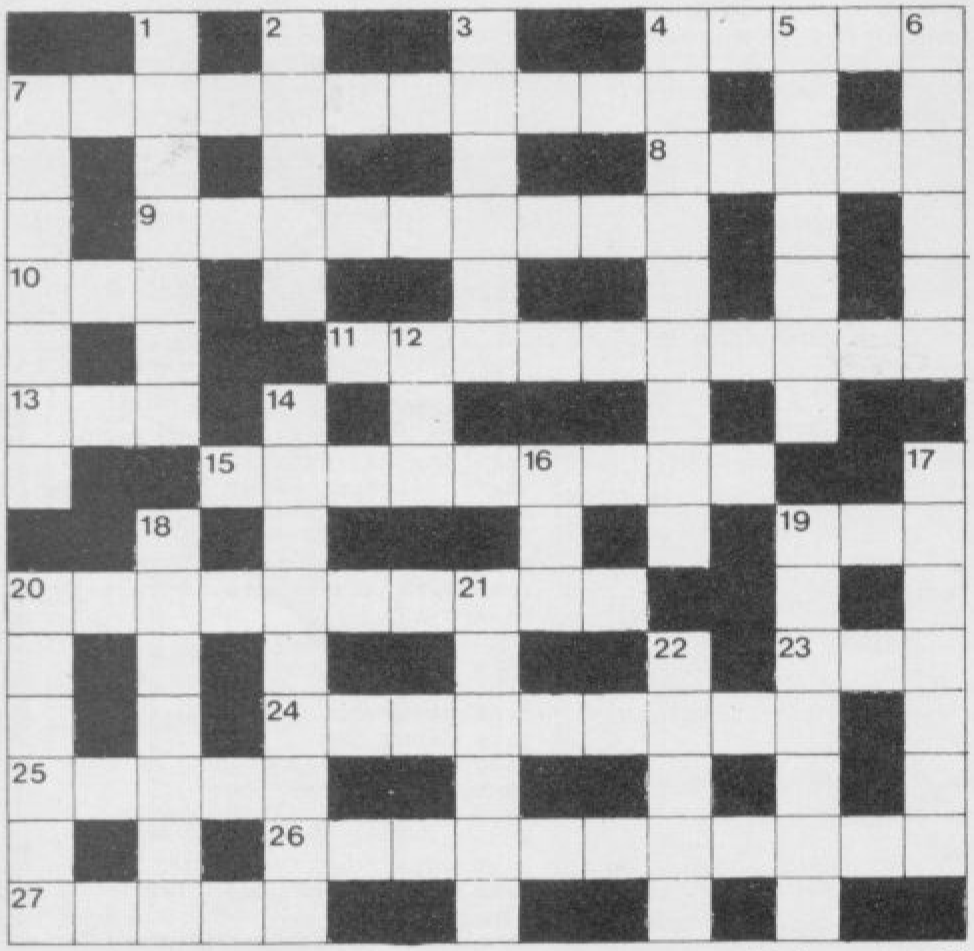
In the next article, we will be using more of these load instructions, and combining them with 'logical' instructions to perform some remarkable and useful screen colour alterations.

LD A , (addr)	— load accumulator with contents of address.
LD A , (rp)	— load accumulator with contents of address held in register pair.
LD reg , reg	— load first register from second register.
LD rp , (addr)	— load register pair with contents of address: C, E or L = (addr) B, D or H = (addr+1)
LD reg , byte	— load given byte into register
LD rp , word	— load register pair with 2-byte number.
LD reg, (HL)	— load contents of address held in HL register pair into a register.
LD (addr) , A	— load accumulator into contents of address.
LD (addr) , rp	— load contents of address with register pair: (addr) = C, E or L. (addr+1) = B, D or H.
LD (HL) , byte	— load byte into the contents of the address held in the HL register pair
LD (HL) , reg	— load register into the contents of the address held in the HL register pair.
LD (rp) , A	— load the accumulator into the contents of the address held in the register pair.

Figure 6. Some Z80 load codes.

ZXWORD

by Henry Howarth



Solution on page 130

Across

4. Pile up in memory area (5)
7. Invention that should put Sinclair Research on the road! (11)
8. Simulation barely seen on page three? (5)
9. Too many GOTO statements in the bolognese! (9)
10. Integration on a large scale (3)
11. Beginner in cloth, oriental, finds software house in *The Hobbit* (10)
13. Digit could be big, but less than a foot (3)
15. Accumulator, perhaps, as transistor electrode (9)
19. Proverbially, it's company . . . (3)
20. Chooses beforehand (10)
23. Some general information (3)
24. Designing a crossword and translating it into machine code? (9)
25. They provide the means of communication in some dialogues (5)
26. Lay out page for software package (11)
27. . . . Proverbially, it's a crowd (3)

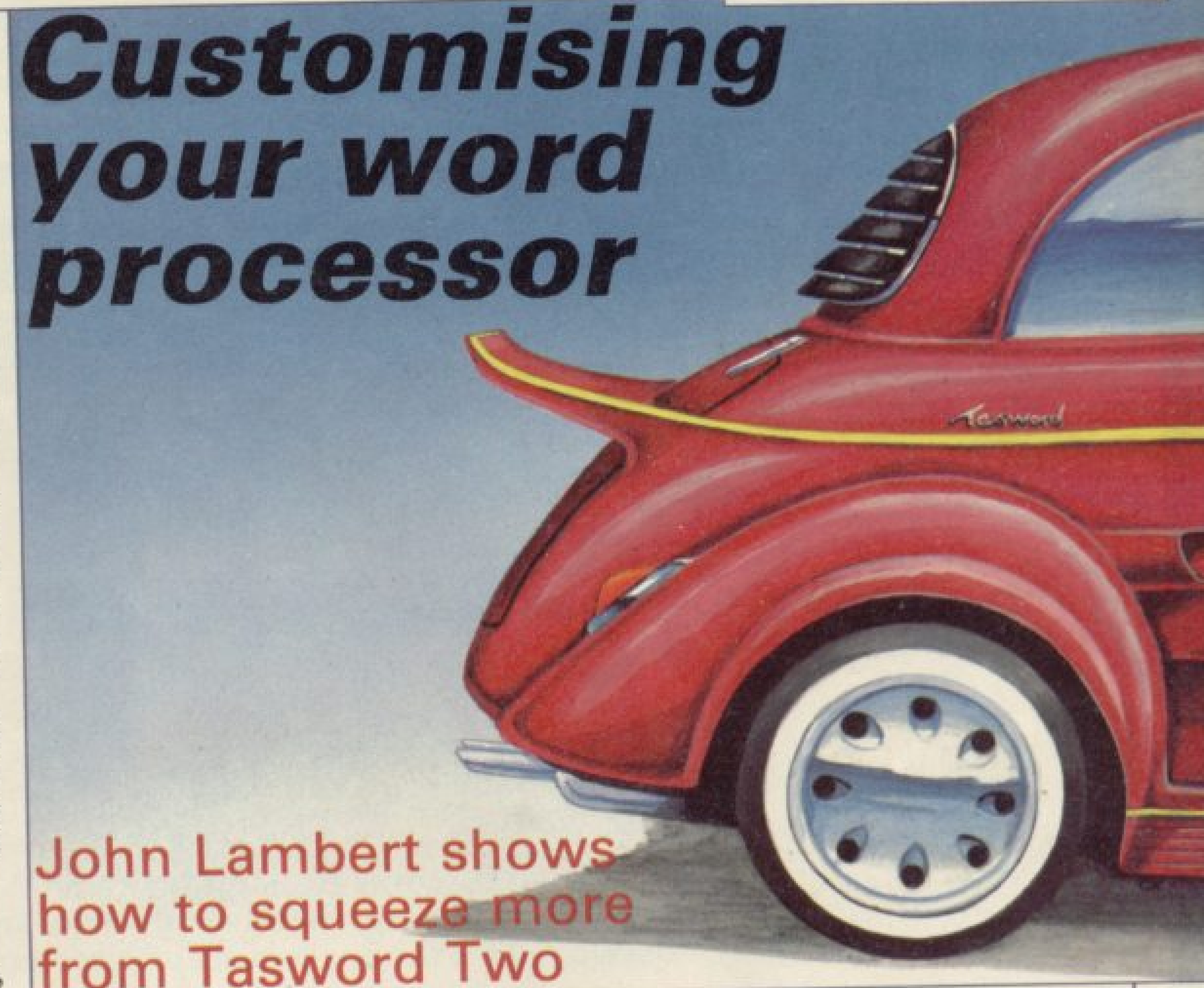
Down

1. Game weapon is miles off beam (7)
2. Team race to get electrical control device (5)
3. Express disapproval of code compiled from source (6)
4. The character of half the large intestine? (9)
5. Radon I'd use to construct an electronic human (7)
6. Absolute unit of temperature measurement (6)
7. Officer misses deadline to compare information (7)
12. Pussycat's companion as BBC logo? (3)
14. Not a capital way to put down the luggage? (5-4)
16. Computer aided training, initially (3)
17. Solder CCENNOT when they're sorted out (7)
18. Redo DEC system for altering data from one format to another (7)
19. Flip-flops got legs! (7)
20. Quick message requesting input (6)
21. Hire PC to crack code (6)
22. Computer generation using valves as principle electronic component? (5)


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Customising your word processor

John Lambert shows how to squeeze more from Tasword Two



Craig Kennedy

TASWORD TWO has, justifiably, proved to be the most popular word processor program for the Spectrum. One of its attractive features is the ease with which you can modify it. The ideas which follow will allow you to customise **Tasword** in a number of ways and all will work on any version. They will also work if you have altered it to use **Tasprint**, the East London Robotics memory upgrade, microdrives and disc drives.

Throughout the article 'direct mode' denotes that commands can be entered directly from the keyboard and will give the OK report; 'Basic' is the Basic part of Tasword, reached by pressing STOP; and 'Tasword' denotes the code part of Tasword, reached by pressing Y from the STOP menu or RUN in direct mode. Sixty four mode denotes 64 characters per line and similarly 32 mode denotes 32 per line.

Changing the colours

As you might have discovered already, you can change the INK and PAPER colours used by Tasword simply by altering them in direct mode and running. That has disadvantages: the paper colour can only be 1, 3, 5 or 7 and the margins will be one less than that. To alter the colours in 64 mode enter, in direct mode

POKE 58512,54
POKE 58513,c
POKE 58521,54
POKE 58522,c

where c is 8 * paper + ink. For example, to get blue paper with white ink use c= (8*1+7) = 15. To change the margin colour enter

POKE 58508,54
POKE 58509,c

where c is calculated as above. To change the border colour enter

POKE 64516,b

where b is between 0 and 7. To change the 32 mode border use

POKE 60641,b

calculating b as above.

Those POKEs will not change the bottom two lines. To change those

POKE 64570,c

and for the second to the bottom line use

POKE 59993,c

calculating c as above. Note that on this line the top half is INK and the bottom PAPER. (To keep the same colours as above you should poke it 7*8+1=57.)

When returning to Basic the INK and PAPER colours are restored to those used before running Tasword but the Border is not. To remedy that add a BORDER command on line 20 before the CLS. As those POKEs are within Tasword they will be retained when the program is saved.

Lines, Characters, Words

When returning from Tasword, to the STOP menu, the program always goes to line 20. When going to Tasword from the Basic part of the program there are two routes, from line 10 — the usual one — and line 3060 — in the process of using search and replace. That can be employed to add a count either of lines or characters used. To count lines add

79 PRINT #0;AT 1,0;a/64;" Lines Used – "; (PEEK 64150+256*PEEK 64151+22)–a/64;" Lines Free"

and to count characters add

79 PRINT #0;AT 1,0;ch;" Characters Used–"; ((PEEK 64150 + 256 * PEEK 64151 + 22) * 64) – ch; " Free"

Alter the USR statements in lines 10 and 3060 to be LET ch=USR, followed by the rest of the line, and add LET a=ch in line 20 after the CLS.

The fastest way to count words is to add a short machine code program. Enter listing one, run it and save the code on tape. Load a copy of Tasword and add the program lines in listing two — you will also have to alter the CLEAR address in line 15 to 31940 and add another LOAD CODE"". To ensure the code is saved automatically add

705 SAVE "word" CODE 31941,59

Alternatively provided you are only using Tasword from cassette add

705 POKE 23736,181: SAVE "word" CODE 31941,59: POKE 23736,181

continued on page 53

Listing 1. word count data

```
  10 LET clr=31940: LET t=0: FOR
 n=1 TO 59: READ a: POKE (clr+n)
 ,a: LET t=t+a: NEXT n: IF t<>640
 5 THEN PRINT "ERROR": STOP
  20 SAVE "word"CODE clr+1,59
  97 REM ************************
  98 REM WORD DATA
  99 REM ************************
 100 DATA 42,181,253,221,42,11,9
2,221,94,4,221,86,5,25,235,33,0,
0,1,0,64,27,26,254,32,40,24
 110 DATA 254,128,48,20
 120 DATA 14,1,16,242,9,58,182,2
53,186,32,232,58,181,253,187,32,
226,229,193,201,175,185,40,234,3
5,13,24,230
```

Listing 2. word count additional basic

```
   1 DEF FN w(x)=USR 31941
  15 SEE TEXT
 174 IF b=119 THEN GO TO 4500
 705 SEE TEXT
4500 CLS : GO SUB 4000: PRINT AT
 11,5;"Number of Words = ";: PRI
NT FN w(a)
4510 PRINT #0;"    Press Any Key
 To Continue": PAUSE 1: PAUSE 0:
 GO TO 20
```

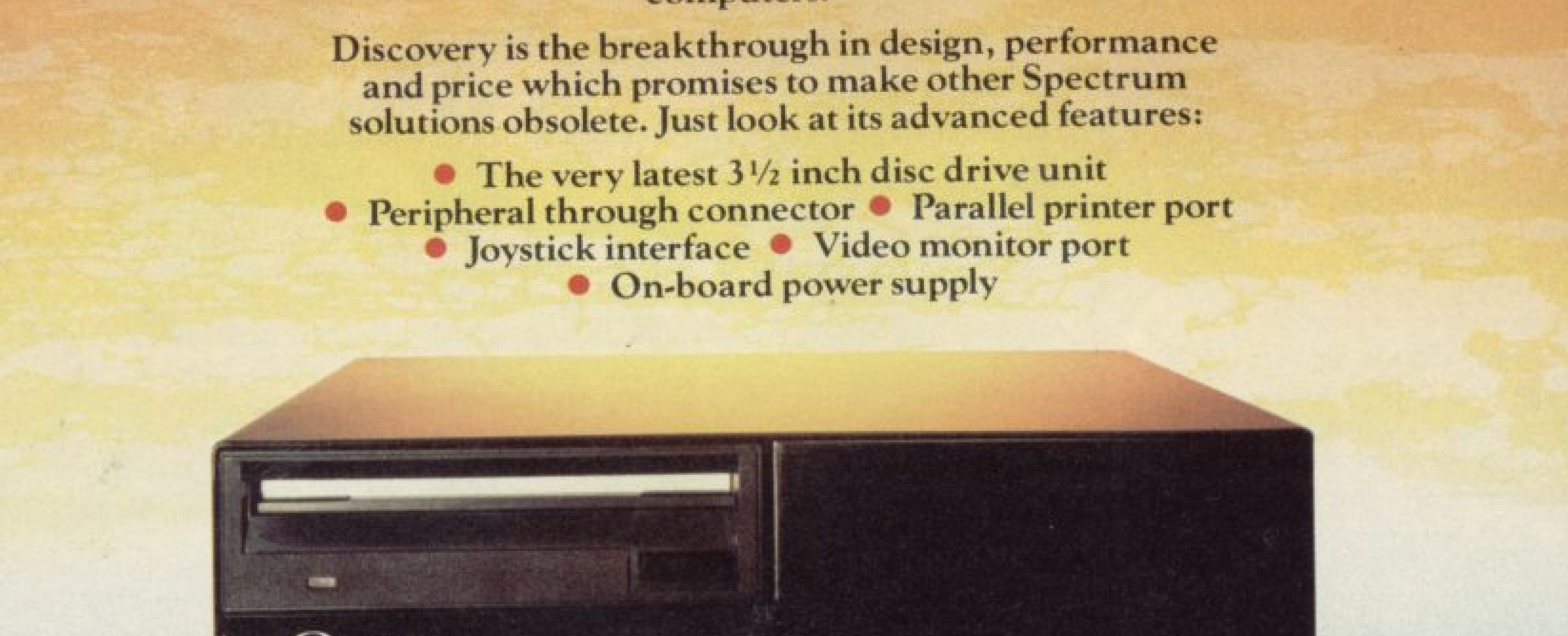
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That will stop the 'press any key' message appearing and save the three parts but will cause odd results if used with microdrives or disc drives.

Once that is done LOAD the word code and then save TASWORD in the usual way.

The routine searches through the file, taking the length from Basic and the start of the file from locations within Tasword, and counts a word as being a non-space followed by a space. It includes words which start at the end of a line, making it a true count.

A space is taken to be a character with a code of 32 or a graphics character with a code of 128 or more. If you do not want to include those graphics then change the four DATA statements in line 110 to zero. If you use **Tasprint** the tilde character — code 126 — is used to change text styles and is treated by Tasword as a space. In that case change the second DATA item in line 110 (128) to 126.

The method of calling the routine may be new to you and relies on the way in which the Spectrum treats user-defined functions and stores numbers. When a function is called the system variable DEFADD holds the address of the definition of that function.

If a single letter is used the memory locations 3 to 7 on from that hold the five byte floating point form of the variable being used. If that value is an integer — between −32767 and 32767 — it can be found in locations 4 and 5. Unfortunately the Spectrum takes a relatively long time to delve into the ROM but the method is useful for routines which require one, or more, parameters to be passed.

Machine code buffs might like to move the word count code to a REM statement for ease of loading and saving.

If you are familiar with the calculator routines in the ROM, you can make use of this method in your own programs; the INT-STORE routine in the ROM at 2D8Ch is particularly useful. For further discussion of the calculator see Helpline in *Sinclair User*, February.

Listing 3. Assembly listing of Listing 1.

```
HL=Word Count
DE=Position in File
B=64 (Characters per Line)
C=Flag 0=Space 1=Non-Space

EA60                     ORG  60000           ;Arbitary ORG
FDB5            FILEST  EQU  64949           ;Address in Tasword
                                              that stores the
                                              start of the file
5C0B            DEFADD  EQU  23563           ;System Variable
EA60 2AB5FD     INIT    LD   HL,(FILEST)     ;Get start of file
EA63 DD2A0B5C           LD   IX,(DEFADD)     ;Pass the value of
EA67 DD5E04             LD   E,(IX+4)        ;a (file-length) to
EA6A DD5605             LD   D,(IX+5)        ;DE
EA6D 19                 ADD  HL,DE           ;HL=start + length
EA6E EB                 EX   DE,HL           ;Move it to DE
EA6F 210000             LD   HL,0            ;HL=Word Count
EA72 010040     NXLINE  LD   BC,64*256+0     ;Load B,64 & C,0
EA75 1B         NXCHAR  DEC  DE              ;Step through file
EA76 1A                 LD   A,(DE)          ;
EA77 FE20               CP   32              ;if Space -
EA79 2818               JR   Z,FNDSPC        ;jump
EA7B FE80               CP   128             ;if Graphic -
EA7D 3014               JR   NC,FNDSPC       ;jump
EA7F 0E01               LD   C,1             ;set flag
EA81 10F2       LINEND  DJNZ NXCHAR          ;if not end of line
                                              get next char
EA83 09                 ADD  HL,BC           ;flag holds state of
                                              first char in line,
                                              add to count
EA84 3AB6FD             LD   A,(FILEST+1)    ;find if address
EA87 BA                 CP   D               ;counter (DE) has
EA88 20E8               JR   NZ,NXLINE       ;reached the
EA8A 3AB5FD             LD   A,(FILEST)      ;start of the
EA8D BB                 CP   E               ;file - if so
EA8E 20E2               JR   NZ,NXLINE       ;then get next line
EA90 E5                 PUSH HL              ;move word count
EA91 C1                 POP  BC              ;to BC
EA92 C9                 RET                  ;and return
EA93 AF         FNDSPC  XOR  A               ;clear A
EA94 B9                 CP   C               ;is flag 0
EA95 28EA               JR   Z,LINEND        ;if so jump
EA97 23                 INC  HL              ;increase word count
EA98 0D                 DEC  C               ;zero flag
EA99 18E6               JR   LINEND          ;back to routine
```

Graphics and Pounds

If you are using a full-sized printer you can send control codes to it using the graphics characters. It is a good idea to add a space — 32 — to the sequence as otherwise the line, when printed, appears to have lost a character. That can be added before or after the sequence. As a matter of personal preference I tend to put it after, except for the underline codes. Code 140 should have it before and 131 after.

The pound sign has caused many headaches. The problem is that, as far as the Spectrum is concerned, the pound has a code of 96 whereas most printers use a code of 35. To further complicate matters the printer also uses 35 to denote the hash character.

It does that by having a number of alternative character sets and you have to switch between them, either using software or by setting switches in the printer. The code of 96 will be printed as a backward apostrophe.

The ideal solution would be to check all the characters being sent to the printer and make the necessary changes. This can be done in software but as it will vary according to the printer and interface used it is difficult to give a general method.

Two methods can be used. The first is to set the printer to use the USA character set so that it will print a hash when sent a code of 35. In that way the hash in listings will be printed correctly.

If one of the graphics characters — say 143 — is set to give the English character set and 128 to give the USA set you can alternate between them at will. You must however remember whether the hash on screen will print as a pound or as a hash.

If you rarely use the hash character the other method will suffice. Set the printer to the English character set and alter the hash character so that it looks like a pound sign on screen. It will still have to be obtained by pressing Symbol Shift 3 but at least you can see what is happening. To do that enter, as a direct command

FOR n = 0 TO 7: POKE (61208 + n), PEEK (61696 + n): NEXT n

The pound sign on the keyboard will still give you a pound on screen so enter

FOR n = 0 to 7: POKE (61696 + n), 0: NEXT n: POKE 61697,4: POKE 61698,2

to change it to a backward apostrophe. Now you have only to remember to press the correct keys but at least what you see is what you get. If you want to use hash you will have to use the graphics characters to swop sets as before.

Help Pages

If you change the uses of the graphics characters you will need to alter the help pages accordingly. The easiest way is to move them into the text file to work on. Enter in direct mode

LET s = FN p(64949): FOR n = 0

continued on page 54

continued from page 53

TO 1407: POKE (s + n), PEEK (54784 + n): NEXT n

which will move it into the file. To return it to its correct place — provided you have not moved it from the start of the file — go into direct mode and enter

LET s = FN p(64949): FOR n = 0 TO 1407: POKE (54784 + n), PEEK (s + n): NEXT n

To work on the Extended mode page replace the 54784 in the above with 56320.

Keyboard

Tasword uses two of the system variables to time its reading of the keyboard. REPDEL at 23561 stores the length of time a key must be held down before it repeats and is normally set to 35. That can be usefully changed to around 20 for fast typists.

One useful modification is to alter the sound made when a key is pressed, as on a rattly keyboard the orginal sound is usually lost. The BEEPER routine in the ROM at 03B5h is used which needs, on entry, the DE register holding the frequency × time and HL holding the length of the timing loop.

Tasword sets D to zero and E to the value of PIP (23609), normally 5 but set to 2 by line 15. The value of HL is held in 59161 and 59162; POKEing 59161,50 gives a loud(ish) typewriter click.

Headers, footers . . .

Listing four is a routine which allows you to add headers, footers and page numbers to a printed text file, and print as many copies as you want. Delete lines 200 to 300 from your original copy of Tasword and type in the listing. Due to memory limitations, headers and footers should be included in the listing as shown.

Lines 200 to 240 should be self-explanatory as they ask for input from the user. Line 250 calculates which part of the text file is to be printed and tells you, on screen, what is happening. Lines 255 and 260 are more calculation. Line 270 puts your header here — remember to allow for the margin. Line 275 is part of the original Tasword Basic and takes into account different printer interfaces; you may find that causes a blank line to be output.

Line 280 calls Tasword to do the printing. Line 285 is similar to 275. Line 290 checks if you want to quit printing; the RUN ensures that all the additional variables created are CLEARed. Line 292 ensures that the page number is printed at the bottom of the page. Line 294 puts your footer here. Line 296 prints the page number; as most interfaces do not handle TAB correctly a number of spaces are LPRINTed. The number is positioned in the middle of the page. PEEK 60927 is the width of the margin.

The routine needs one memory location to store the number of text lines per page and I have used 31940 for that. You will have to alter the CLEAR in line 15 to 31939. Alternatively, you could use one of the unused locations in the system variables, 23681, 23728 or 23729, provided your printer interface does not use it.

The routine has been made as short as possible but if you use a microdrive or the Thurnall, Statacom or Watford disc systems you may find you get an 'out of memory' error. That is because those systems use memory when loading or saving. Using cassette, or the Technology Research disc system, does not.

Try the routine using a file which you have safely saved. If you do get the 'out of memory' report you will have to shorten the Tasword Basic. Two methods can be used, both of which are used in the routine. The first is to change all the numbers to use VAL — that is 123 becomes VAL"123" and so on — and that will save three bytes per number. It may not seem a great deal but in the routine 200 bytes are saved by this method.

The second method is to use variables in place of numbers. In the routine z is used for zero and u for one. If you add LET z=0: Let u=1 to line 10 and then change all occurences — omitting line 15 and the subroutine at 4000 — you can save a further three bytes every time.

Depending on your version of Tasword you can save up to 1.5K which is more than enough for this routine and any of your own. As long as you have 700–800 bytes free you should not have any problems — to check the amount of free memory enter

PRINT 65535−USR 7962

Finally . . .

All the above will prove useful and enhance what is already an impressive program. If you have further ideas for improvements I would be pleased to hear from you c/o *Sinclair User*.

Listing 4. Print routine for headers, footers, page numbers and multiple copies

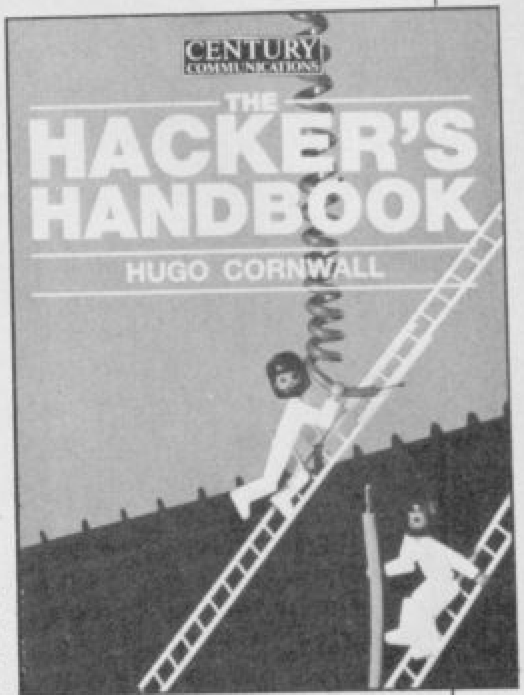
```
 200>CLS : GO SUB VAL "4000": PR
INT AT VAL "4",VAL "8";"PRINT OP
TIONS": PRINT "  just press ENTE
R for default    values given in
 brackets": LET z=VAL "0": LET u
=VAL "1": LET gs=VAL "6000": LET
 i=VAL "8": LET j=z: LET j0=VAL
"23": LET x=VAL "31940": LET a$=
"Text Lines per Page ": GO SUB V
AL "850": LET i=VAL "10": PRINT
AT i,z;"Line Spacing? (1)": GO S
UB gs: IF a$="" THEN LET a$="1"
 210 POKE VAL "62235",VAL a$: LE
T i=VAL "12": PRINT AT i,z;"Star
t at line? (1)": GO SUB gs: IF a
$="" THEN LET a$="1"
 220 LET c=VAL "64"*(INT VAL a$-
u): LET st=c+FN p(VAL "62216"):
LET i=VAL "14": PRINT AT i,z;"Fi
nish at Line? (last)": GO SUB gs
: IF a$="" THEN LET len=a-c: GO
TO VAL "230"
 225 LET len=VAL "64"*INT VAL a$
-c
 230 LET i=VAL "16": PRINT AT i,
z;"First Page Number (1)": GO SU
B gs: IF a$="" THEN LET a$="1"
 240 LET pa=VAL a$-u: LET i=VAL
"18": PRINT AT i,z;"Number of Co
pies (1)": GO SUB gs: IF a$="" T
HEN LET a$="1"
 250 LET co=VAL a$: LET end=st+l
en: LET pl=INT (PEEK VAL "31940"
/PEEK VAL "62235")*VAL "64": LET
 tp=INT ((len/pl)+u): FOR n=u TO
 co: LET fl=z: LET cp=pa: FOR f=
st TO end-u STEP pl: LET b=f: LE
T x=VAL "60045": GO SUB VAL "950
": LET cp=cp+u: RANDOMIZE USR VA
L "59806": RANDOMIZE USR (FN p(V
AL "62472")): CLS : PRINT AT VAL
 "10",z;"Press the q key to quit
 printing";AT VAL "14",z;"Printi
ng Copy Number";n;AT VAL "18",z;
"Page Number ";cp: IF end-f<pl T
HEN LET b=end-f: LET fl=u: GO TO
 260
 255 LET b=pl
 260 LET x=VAL "60049": GO SUB V
AL "950"
 270 REM LPRINT "Header"
 275 LET c=PEEK VAL "62470": IF
c<>z THEN LPRINT CHR$ c
 280 RANDOMIZE USR VAL "60038"
 285 LET c=PEEK VAL "62471": IF
c<>z THEN LPRINT CHR$ c
 290 RANDOMIZE USR VAL "59806":
IF INKEY$="q" THEN RUN
 292 IF fl=u THEN FOR g=u TO (pl
-b)*PEEK VAL "62235"/VAL "64": L
PRINT : NEXT g
 294 REM LPRINT "Footer"
 296 FOR g=1 TO 25+PEEK 60927: L
PRINT " ";: NEXT g: LPRINT "Page
 No ";cp;" of ";tp: LPRINT CHR$
12: NEXT f: NEXT n: RUN
```

Variables used in Listing 4.

```
 st = start of file
len = length of the file
 pa = first page number
 co = number of copies
end = end of file
 pl = length of page (to be printed)
 tp = total number of pages
 fl = flag
 cp = current page
```

There is one problem, at least, to which I do not have the answer. The length of the text file (−22) is held in locations 64150 and 64151. Try POKEing 64150,122, RUN Tasword, clear the text file — E Mode X — and scroll through it. How do you get rid of line 357?

Carry on hacking. . .



SO WHO is 'Hugo Cornwall', author of *The Hacker's Handbook*?

Biographical details given include the astonishing career details of a man who has a First in Mathematics from Oxford, has worked in a 'government supported facility in Gloucestershire' and in the South Atlantic. He is now, apparently, living in Brecon, mid-Wales.

Those details are spice on the cake as far as selling the book goes, and *The Hacker's Handbook* is crammed full of information and advice for would be hackers.

With worries about the security of data systems and computer fraud running at fever pitch, Cornwall insists that hackers are not intent on crime as such and states the hacker's aim, 'to boldy pass where no man has hacked before'.

The author is probably correct when he states that more information could be gleaned by judicious phone calls and contacts than ever would be gained by hacking round the networks. In fact, banks and such authorities as Prestel should thank hackers for pointing out the weak spots in their security systems.

The Hacker's Handbook is also a historical work detailing the results of famous hacks, like the Telecom Gold hack. It is an extremely useful handbook for anyone with a modem who wishes to explore a bit further than the pages of Micronet, containing as it does lists of protocols and radio frequencies together with advice from someone who is obviously an expert in network exploration.

Hugo Cornwall has laid down a challenge to his readers: who will be the first to hack his identity? That reminds me, I must contact my friends in mid-Wales.

Theo Wood

Publisher Century Communications
Price £3.95

. . .hack and hack again

HACKING is a popular topic and it is not unusual to find several books which cover the same subject. What is unusual about this book is that it is called *The Hacker's Handbook*.

This book is published by Longman, not Century Communications. It is not illegal for two books to have the same title but it can be confusing.

Luckily, the books differ in approach. This book, by Geoff Wheelwright and Ian Scales, deals with only the Spectrum and much of it is concerned with the Micronet information database to which Spectrum owners can connect using a VTX 5000 modem.

It gives an overview of the system and provides information on Prestel, and Homelink — the home banking database.

For those who are seriously into hacking the authors provide information on the hardware and software which you will need to get into such databases.

Section one shows how modems work and examines terms such as baud rates, parity and duplex.

Section two takes a look at electronic mail and bulletin boards, which can be accessed over a telephone line with a modem and provides a list of British bulletin boards with telephone numbers.

A glossary of terms completes what is a very interesting and practical book. They could have changed the title, though.

John Gilbert

Publisher Longman
Price £5.95

QL — official secrets

AT LAST it's here. *The QL Technical Guide*, by David Karlin and Tony Tebby, took more than a year to escape from the inner sanctum at Sinclair Research but, due to great public demand — and outrage — those guidelines have seen the light of day.

The neat A5 book, complete with hardy ring binder cover, is a pale imitation of the full QDOS specification which is available to software houses if they shout loud enough but it is certainly worth the wait, and worth its weight in gold. Not only does it cover the utilities available through QDOS but it provides blueprints of the memory map, information on system variables and, all the data you need on that nefarious subject, multi-tasking.

Skimming through the 195 pages of text and index gives a good idea of the IQ rating necessary to understand most of the information in the manual. You do not have to be a genius but it does help. The technical manual is not meant for the SuperBASIC programmer. You do need some knowledge of 68000 code and general knowledge of traps and other interrupts. If you have the background the book will give you all you need to know about the internal workings of the QL.

One area that it purposely does not cover, however, is the hardware of the machine. No chip specifications are given and there is not one blueprint hidden within the volume. The authors explain that such design blueprints would be 'giving you a route to build products which rely on non-supported elements in the QL design.' In other words, you might start to use some of those hardware functions within the 68008 which are not supported by the QL.

The book is expensive at £14.95 but there are factors which make it an imperative buy for a machine code programmer. On the QL you should always go through QDOS. Both authors are intimately connected with Sinclair and work on the QDOS operating system. The other reason for purchasing the manual is that it does not hold information back from the reader. If there is something that you need to know about QDOS it is likely to be in the manual.

The QL Technical Guide is a great box of assorted tricks. If you want to perform magic on your QL you should buy it.

John Gilbert

Publisher Sinclair Research
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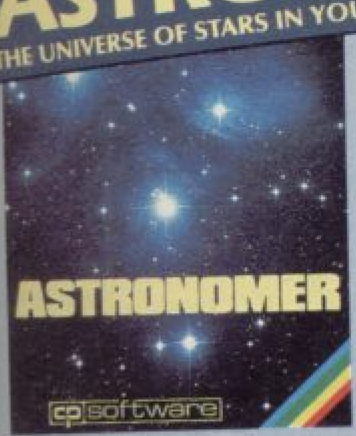
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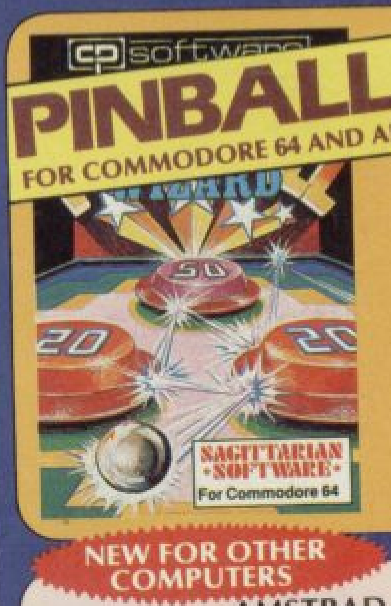
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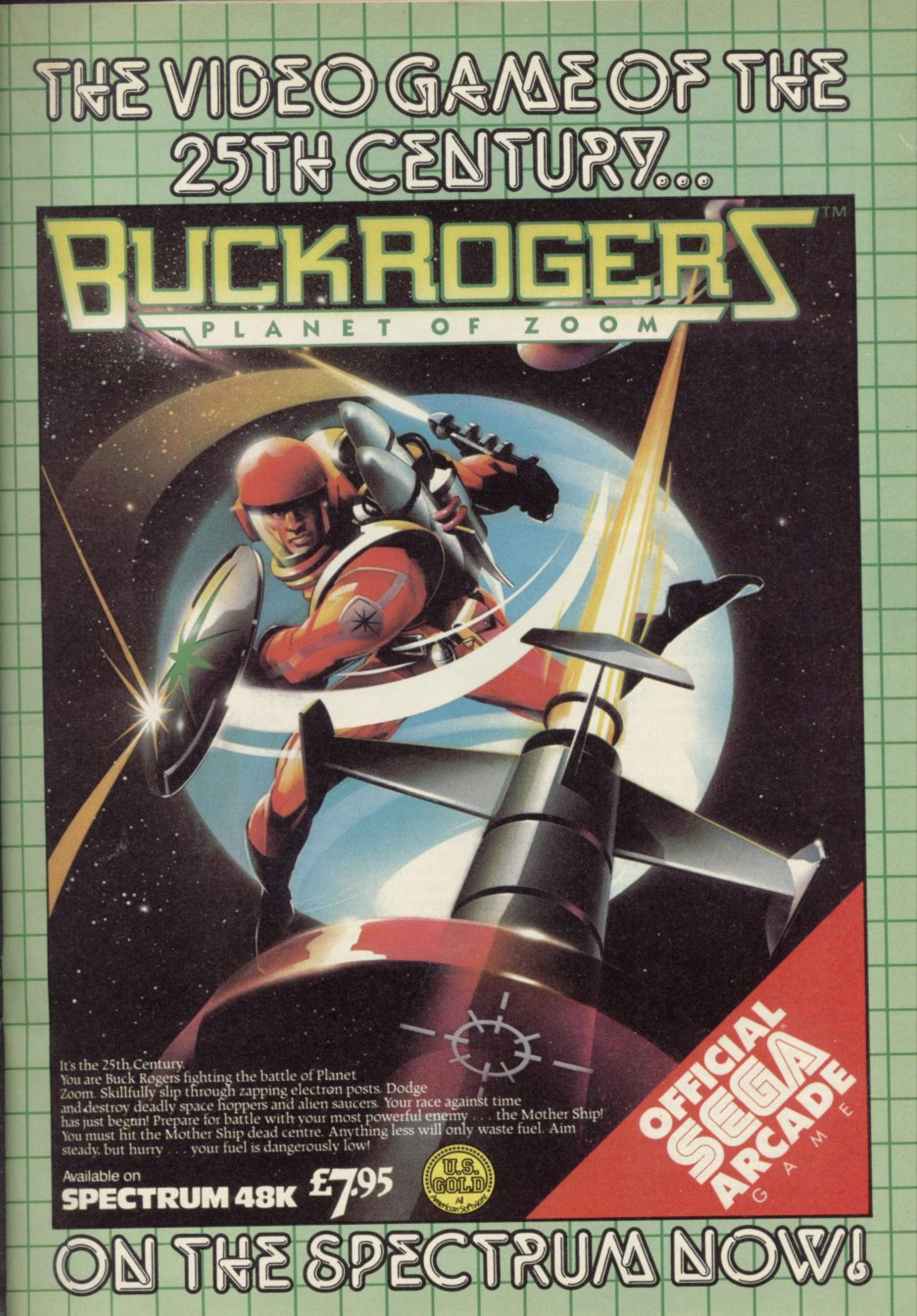
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Nick and Pete Austin, space pioneers

Photo: Henry Arden

Another time, another space. Chris Bourne reaches Level 9

PETE AUSTIN contemplates an empty beermug in a High Wycombe pub, trying to decide whether he wants another half before he leaves. In doing so he displays the same measured concentration that his victims in alien worlds must employ to avoid sudden death from any one of a myriad traps.

For Pete is the king of British adventure, the driving force behind Level 9 Software. His company has won a name for text adventures in the classic tradition — **Colossal Adventure, Lords of Time, Snowball** — vast games of 200 or more locations, with more puzzles than was believed possible on a standard home micro.

Pete's interest in fantasy games goes back to the days of graph paper and dice. At school he became involved with table-top wargaming, sending battalions of Sherman tanks across the chipboard to flush out the German armoured defences.

Later, at Cambridge University, where he studied Psychology and later Computer Science, he discovered *Dungeons and Dragons*, the fantasy role-playing game.

You can tell from the way Pete talks about the game that he was once a dedicated fan, whatever occupies his time now. He and his friends also played a game called *Empire of the Petal Throne*. "In the evenings we either played D&D or we went down to the pub . . . and played Petal Throne."

Computing began with a course at Cambridge "which was really just an excuse to stay there for an extra year." On finally dragging himself away from the ivory towers, Pete set off in search of fame and fortune. He became a programming consultant and worked for 18 months on an enquiry package for banks and suchlike. No glittering prizes for young Pete Austin.

"You don't get much choice about your next package," he says. "I got put on an accounting package. There had already been 50 people working on it. You end up writing very defensive code. I didn't fancy that as a full-time job."

Pete moved to mainframe manufacturer Perkin-Elmer. He had lost touch with his D&D friends but discovered, to his lasting joy, a version of the original Crowther and Woods **Adventure** program on the main computer there. "We played it during the lunch hours. There had been a number of simpler games on the computer at Cambridge, based on the D&D format. **Adventure** was full of puzzles, many of which were extremely unfair. I cracked it in two weeks."

He smiles at the memory. Two weeks to beat **Adventure**? Most people take six months. Pete is still proud of the achievement.

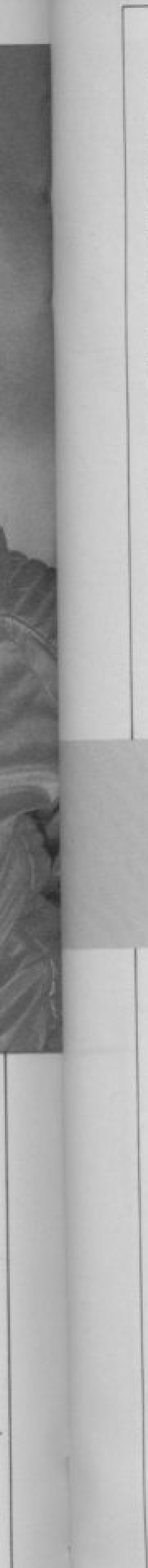
Pete has two younger brothers, Nicholas and Michael, and a sister Margaret. While he was still working for Perkin-Elmer, he and the brothers formed Level 9 in order to utilise their combined computing expertise. Nicholas studied computer science at London university and Michael is currently reading engineering at Southampton. "He doesn't need to do it," says Pete. "He could teach it instead."

Margaret joined later to take over marketing, and recently their father John, having retired from the BBC, came in on the act, soon to become managing director.

Do you remember the Nascom? It was one of the first home micros, in the days of kits and small RAMs. Pete bought a Nascom, and Level 9's first program was an extension to Nascom Basic. It sold well. In those days business was good with sales of 500 or more.

The first game, also for the Nascom, was called **Fantasy**. Pete says it was like **Valhalla** but with no graphics. "There were a lot of characters wandering around who changed according to your actions. What I did was to make it print out in proper English. I'm interested in the user interface, what used to be called front-end programming."

Indeed, the series of adventures which has since flowed from Level 9 is renowned for high standards of plot and literate description, in spite of notorious spelling mistakes. Pete is irked by 'climable' which still remains in **Colossal Adventure**, despite numerous corrections to each new edition.



On the level

Colossal Adventure, a faithful version of the Crowther and Woods original, took about a year to produce, and was written for the BBC and Spectrum simultaneously. The cramped office at Level 9 has three BBC micros as well as an IBM PC. No Spectrums were in evidence, although Pete insisted there were plenty about.

Level 9 uses a standard adventure writing system for its products, which was designed by Pete himself. "Michael then coded it using the a-code language which he invented for the purpose. I did the text compression section. We brought out Colossal because there were no adventure games around of a decent size. I thought it must be possible to do it in less than 32K. I saw it as a way of getting back into fantasy wargaming."

To squeeze what was orginally a 200K mainframe program into 32K, and then to add an extra 70 locations just for the fun of it, was no mean feat. Pete's text compressor has been a feature of all Level 9's mammoth adventures. It works by running through all the messages and searching for common strings.

For example, 'ing' might occur frequently. The compressor replaces 'ing' with a single code wherever it occurs. That done, it goes through again, and again, each time saving more space. "It doesn't always pick up what you'd expect it to," explains Pete. In the phrase 'in the room' the compressor might decide that it was more efficient to use a code for 'n th' and 'e r' rather than pick out 'in' and 'the'. That is not something which occurs to the human mind.

The system has been rewritten to create graphics as well. Level 9 can now store a picture in about 30 bytes, using a similar method to the text compressor. That means a 200 location adventure — the minimum Pete will allow — can have a picture for each location for only another 6K of RAM.

Not content with these two areas, the a-code compiler even compacts Basic program lines. "Most Basic systems have keywords which use a single byte," explains Pete. "We go further. We take out the arguments so that each Basic instruction only uses two or three bytes."

Colossal Adventure was followed by two sequels, **Adventure Quest** and **Dungeon Adventure**, collectively known as the Middle Earth Trilogy, referring to Tolkien's mythical setting for the *Lord of the Rings*. "Trilogies help. **Adventure Quest** sells as people play Colossal. Middle Earth was a convenient fantasy setting. It was a way of telling people the type of world they were getting."

For the next project, Pete decided to switch to science fiction, and began to create the Silicon Dreams trilogy. "There are far too many generalised fantasy games," he says. "The authors are OD-ing on sword and sorcery novels."

The first SF game, **Snowball**, featured 8000 locations and involved spaceperson Kim Kimberley in a giant space station dangerously out of control. Is the androgynous Kim a man or woman? Pete says she's a woman, while sister Margaret says he's a man. Pete considers the point. "No, there's a credit at the end for the design of 'Ms Kimberley's costume'."

Was the ambiguous picture of Kim in the instruction booklet deliberately vague? "It's very accurate," says Pete. "I got the artist, Tim, to draw women the way they are, not exaggerating various features. But it was a deliberately unisex name."

Pete explains that about a third of the people who write to the company are women. "I'm aware of the female audience. I always try to write nonsexist prose."

He goes into some detail on the design of Kim's costume, and why the leotard would make a fine spacesuit in the right sort of material. It is typical of the man that he should have considered such problems. The Silicon Dreams trilogy is meticulously plotted and designed, with features and history stretching well beyond the confines of the game itself.

"SF books I like the most are those where people have paid attention to detail. I don't mean like Arthur C. Clarke where what you get is more like an engineering manual, but authors like Larry Niven — if you make certain assumptions about things like ramships then it all hangs together.

"A game is more like a play than a novel — it has a similar number of words. I would like to put more in than puzzles. Most other adventure descriptions just link puzzles together. It doesn't cost much in memory space to create a logical world."

Pete tells of one nit-picking reviewer who spotted an error in the detail. "Apparently Eden, the planet, is orbiting Eridani E instead of Eridani A," he says, explaining that Eridani E is the wrong type of star. Or is it A? "No one gives a damn except this reviewer. But **Worm in Paradise** will change that. I shall explain how the planet moved. The game ends with mankind getting to the stars via an alien transportation system."

Worm in Paradise is to be the final part of the trilogy, the second, **Return to Eden**, was released late last year. In that, Kim must battle against deadly plant life and evade the rogue robots of the colony planet, who believe her to be a saboteur for her attempts to save the space station in the first game, **Snowball**.

"Worm is set on Eden, about 50 years in the future," says Pete. "The player is not Kim — she becomes mayor and runs the place. She defeats the plans of the robots to make the colonists have lots of babies to colonise the Universe. I looked at the original and thought it was as anti-feminist as you could get, so I thought to redress the balance. Because you know less than real people would about our society, I have the player escape from an asylum. It explains why you don't know anything and have no possessions." Thoughtful of you, Pete.

Meanwhile, rather than become stuck in the rut of trilogies, with each game taking about six months to design and program, Level 9 has also been branching out into other areas. The light-hearted **Erik the Viking**, based on ex-Python Terry Jones' children's book, was written for Mosaic, a publishing house which is branching

continued on page 62

continued from page 63

into nine separate parts, most of which are neatly compartmentalised but some of which are scattered throughout the table.

1 — not used. The codes have no effect.

2 — control commands. Produce an effect other than printing on the screen. (See below)

3 — special characters. Includes arithmetic signs, punctuation, percent, dollar and hash.

4 — numbers.

5 — capitals.

6 — lowercase characters.

7 — block graphics.

8 — user-defined graphics characters.

9 — keywords.

Out of those catagories 1 and 2 produce nothing on the screen. As stated, 1 will produce no effects and 2 provides special effects using two Basic language functions.

Firstly, however, you can see the effect of those printable characters using the Basic function CHR$ followed by one of the codes within brackets. If you wanted to print the letter A on the screen you would look up the code, which is 65 and type:

PRINT CHR$ (65)

The letter A should then appear at the top of the screen.

You can chain groups of letters to form words by using the '+' sign, in a similar way to that shown in last month's article. The format then is PRINT CHR$ (code) + CHR$ (code) . . . If you wanted to display 'Guide' you would type:

PRINT CHR$ (71) + CHR$ (117) + CHR$ (105) + CHR$ (100) + CHR$ (101)

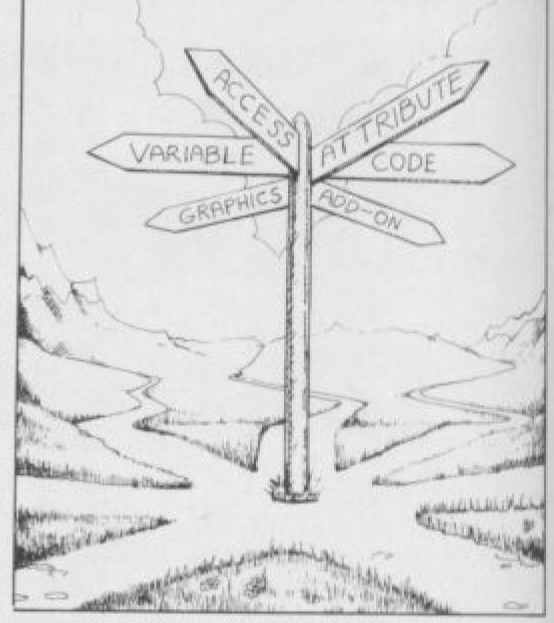
It is also possible to convert characters to their numeric code representations using another Basic function, CODE which contains the character in brackets and within quotation marks. The instruction PRINT CODE ("A") would display the number 65 on the screen.

As with most other Basic instructions constants can be replaced with variables. You could, therefore, have put a variable between those brackets. The program below demonstrates the point. It uses a simple loop to print out the alphabet and its corresponding codes.

```
10 CLS
20 FOR K= 65 TO 90
30 PRINT CHR$ (K); "="; K
40 PRINT
50 NEXT K
```

The program demonstrates the conversion principle which is used in this month's Entry Program, listing one, where a block of text can be entered and stored in code form in memory. Such a block can be accessed from programs using the POKE instruction and memory saved by packing text and not using variables.

The non-printable characters, which were briefly discussed earlier, provide short ways of executing instructions which are usually the province of Basic instructions. They range between codes six and 23. They can be used with the ordinary CHR$ instruction and put within any Basic print statement.



You may want to split the word GUIDE into two parts, the split taking place after the letter U. To do that type:

PRINT CHR$ (71) + CHR$ (117) + CHR$ (13) + CHR$ (105) + CHR$ (100) + CHR$ (101)

Put in the line and the display should look like

GU
IDE

The CHR$ (13) function performs an ENTER and the rest of the word is printed on the next line. The other codes perform in a similar manner but INK and PAPER require numbers to give the computer an instruction of the colour to be used by the function.

There is a lot of fun to be had experimenting with various code combinations and, looking at listing one, you will be able to work out uses for them. Whatever you do, however, you will soon find that numbers are all to the Spectrum.

Listing 1: The routine shows the way in which text can be broken down and stored as a block in RAM memory using the POKE, PEEK, CHR$ and CODE instructions and functions. First each value is poked into a RAM cell and then the whole area of RAM is scanned and the numeric representation of the block of text is shown on the screen. You have ample opportunity to turn this simple routine into a code maker or code breaker program.

Line 5. The CLEAR instruction removes any values in the variables area of RAM and releases sections of memory which have been tied up for use by the operating system or in running other user programs. A safety measure which clears memory.

Line 10 clears the screen display and line 20 asks you to enter your block of text. Try short sentences for clearer results.

Line 20 puts the first RAM cell which is to be used into the variable A.

Line 30 starts a loop which is dependent upon the number of characters in the A$ string. For instance, if A$ contained HELP the loop would go around four times.

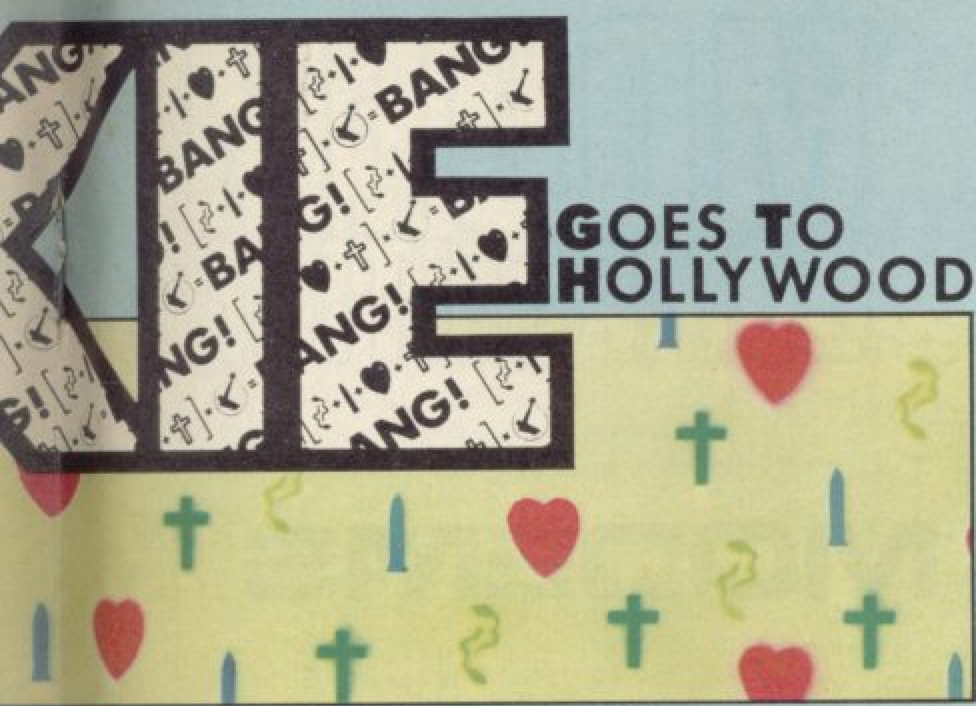
Line 40 contains the first POKE. It uses the current value of variable A as the address into which it puts the code number of the character sliced by the instruction A$ (K TO K) — see last month's article. For instance, if loop variable K contained 1 it would put the first character of the string A$ into the RAM cell. The line could be made shorter by making A$ (K TO K) to A$ (K) — after all, you are looking for only one character not a range.

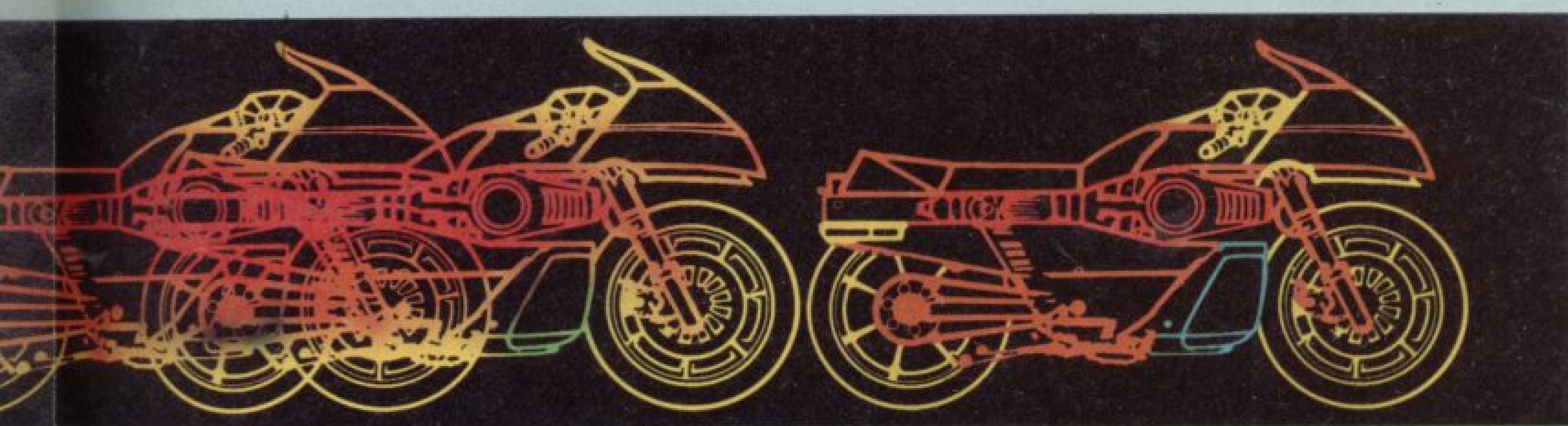
Line 50 adds one to the address number stored in A and line 60 loops back to 30 until the whole string has been scanned and translated. That is the end of the translation section of the routine and RAM now contains a numeric representation of your string.

Lines 70 to 90 display those values on the screen. Line 70 starts a loop which uses 32768 as the base address — the one in which the first string character is stored — and will loop around until we reach the end of the original A$ length. The −1 suppresses a zero from the end of the translation as it is shown on the screen.

Line 80 PEEKs the number stored at the address being scanned, putting a space between each value and line 90 NEXTs to line 70 where the process is repeated until the whole of the string numeric representation is displayed.

```
 5 CLEAR
10 CLS
20 INPUT "TEXT ";A$
25 LET A=32768
30 FOR K=1 TO LEN A$
40 POKE A,CODE (A$(K TO K))
50 LET A=A+1
60 NEXT K
70 FOR K=32768 TO 32768+LEN A$
-1
80 PRINT PEEK (K);" ";
90 NEXT K
```


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Q3 ....
Q4 ....
Q5 ....

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....
.... "

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☐ COMMODORE 64

D. My home telephone line (* Delete as appropriate)
(a) already has a square-type BT 'phone socket * or
(b) would need converting to square-type BT 'phone socket *
If (b), the person renting the line from British Telecom must fill in this declaration – If this is a winning entry, I agree to ask British Telecom to convert my line to square-type BT 'phone socket at a convenient date before 1st July 1985. My line is on Residential rental, is not a coinbox and is not shared service. I understand British Telecom will not charge for doing the work.

Name .... (Block Capitals)
Telephone number ....
Signature ....
Date 1985

E. I have read the rules of the British Telecom Modem competition and agree to abide by them. I am over 18 years old.

Signature of entrant ....
Date 1985
Name .... (Block Capitals)
Address ....
....
.... Postcode ....

POST IMMEDIATELY TO:–
British Telecom Modem Competition
PO BOX 73
MITCHAM
SURREY
CR4 2XU SU (Postage stamp required)

WINNERS WILL BE NOTIFIED AUTOMATICALLY

Structure made simple

John Gilbert's forthcoming book draws a blueprint for programming

THERE are two ways of writing a program, unstructured programming and structured programming. The second is preferable in terms of speed and accessibility. It also lends itself better to the principles of SuperBASIC which is one of the reasons why it was developed.

Unstructured programs are usually difficult to read, especially if they contain hundreds of instructions. Some REMark statements may have been put into the program but you will have to scan the whole listing in order to correct an error.

Alternatively, the simple techniques of structured programming ensure that you do not have to look through hundreds of lines of your program in order to find the parts which are giving you an error message. You may only have to look through five or six lines. Also, using structured techniques you should halve the number of errors which occur.

Even unstructured programs have a pattern. One line follows another and GOTO statements are used not once or twice but hundreds of times, usually to alter the flow of the program in order to get around errors or other problems.

```
10 AT 10,0:PRINT"DO YOU WANT INS
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20 INPUT AN$
30 IF AN$="Y" THEN GO TO 120
40 IF AN$="N" THEN GO TO 60
50 GO TO 10
60 PRINT"THIS IS THE MAIN CORE"
70 PRINT"OF THE PROGRAM IN WHICH
"
80 PRINT"ALL THE INFORMATION IS"
90 PRINT"PROCESSED"
100 PRINT"IT FINISHES HERE"
110 GO TO 170
120 CLS:AT 0,10:PRINT"INSTRUCTIO
NS"
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Although there are no errors in it, the program above is difficult to read and unless it was made obvious, as it has been here, which part performs which task, those jobs would be difficult to work out.

The program starts simply enough by asking whether the user needs instructions and then goes to the instructions further down the listing if they are required. If no instructions are needed the QL will go on to the main part of the listing.

The listing is made confusing by placing the instructions in a seemingly random fashion following the main meat of the program. The program could, however, be rewritten using the structured technique with some of the instructions at your command in SuperBASIC.

Splitting into subroutines

SuperBASIC is a specially structured language and there are several ways in which the above program could be made to run faster and be easier to read.

The first action is to strip the program into subroutines. Look at the lines of the program and see what they are doing. Find out all the tasks which the computer has to do while the program is running and then separate those tasks so that each forms a routine. Those routines are put together within the program and executed one at a time.

The program asks you whether instructions are required. If they are not then it goes on to perform the main core which is to simply print out a few lines of text onto the screen.

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If you are to make a good job of the program you will have to do more than structure it into subroutines, so you might as well tidy it and add a title page. Error trapping is noticable by its absence so you could add that as well.

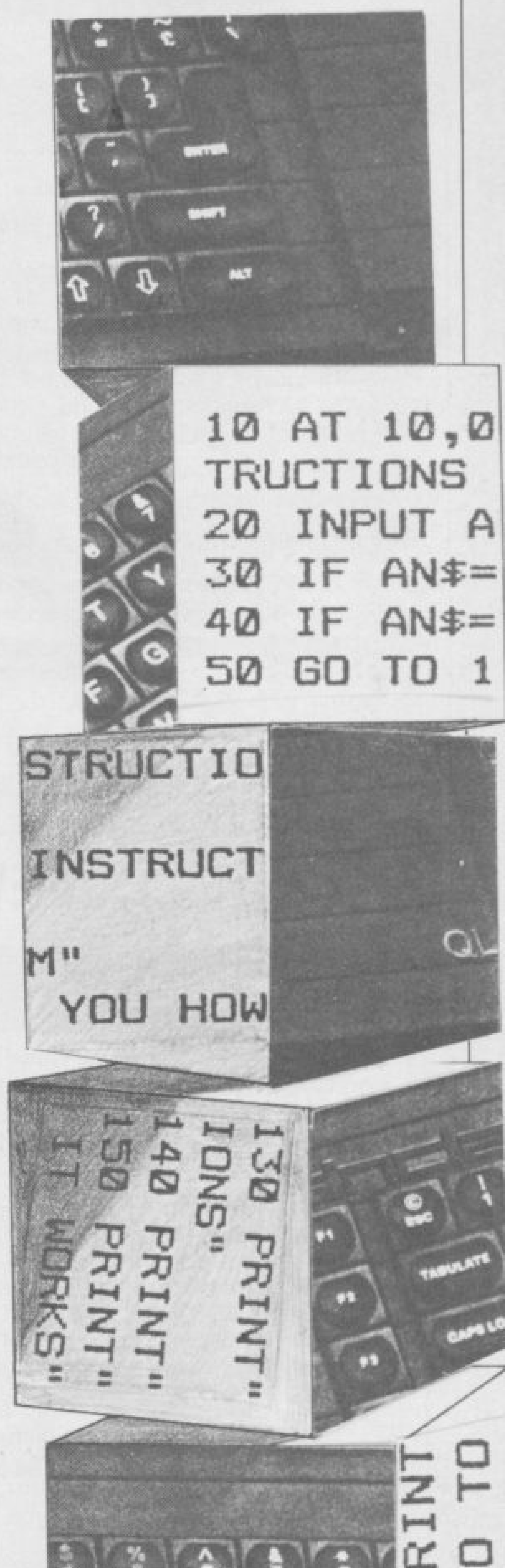
The first rough draft of the program would look like this:

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continued on page 71



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For the 5 questions 'phone
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031-225 8999

To get the Tiebreaker Sentence 'phone
01-627 1199 or
0532 455030 or
0632 324444

Complete the entry form using your skill and judgement, and send it off in the next post.

RULES OF THE BRITISH TELECOM MODEM COMPETITION

1) The dial-in is available from 6pm Monday 22nd April to midnight Sunday 5th May 1985, when the competition closes.
2) Entries must be postmarked the next working day after the questions and tiebreaker were obtained.
3) Entries can only be made on the official entry forms and become the property of British Telecommunications plc.
4) The competition is open only to residents of the United Kingdom over the age of 18 years. Employees of the Network Marketing Unit of British Telecommunications plc and PARKER REDMILE LTD. and their dependants are excluded. Only one winning entry per household.
5) Entries not reaching the competition address before midnight on Thursday 9th May 1985 will not be considered.
6) A list of winners will be provided at the competition address. Please send an SAE if you wish to receive it.
7) The winners will be picked as follows from entries received on time and properly completed –
The entries for each type of prize pack with all correct answers to the 5 questions and with the tiebreaker sentences judged most apt and humorous by the competition organisers will be chosen, subject to the stock of appropriate prize packs.
8) The decision of the competition organisers is final and no correspondence will be entered into. Winners will be notified automatically.
9) British Telecommunications plc offers winners requesting BT 'phone socket conversion on entry forms to waive the charge normally made for such work.
10) Details of how to get on Prestel/Micronet 800/Telecom Gold will be sent to winners. Subscriptions not included in prize.

OFFICIAL ENTRY FORM

A. Your answers:
Q 1 ....
Q 2 ....
Q 3 ....
Q 4 ....
Q 5 ....

B. Tiebreaker Sentence complete (25 words or less in total):
" ....
....
.... "

C. If I win, I would like the prize pack for the
☐ SPECTRUM/SPECTRUM +
☐ BBC MODEL B (Tick Choice)
☐ COMMODORE 64

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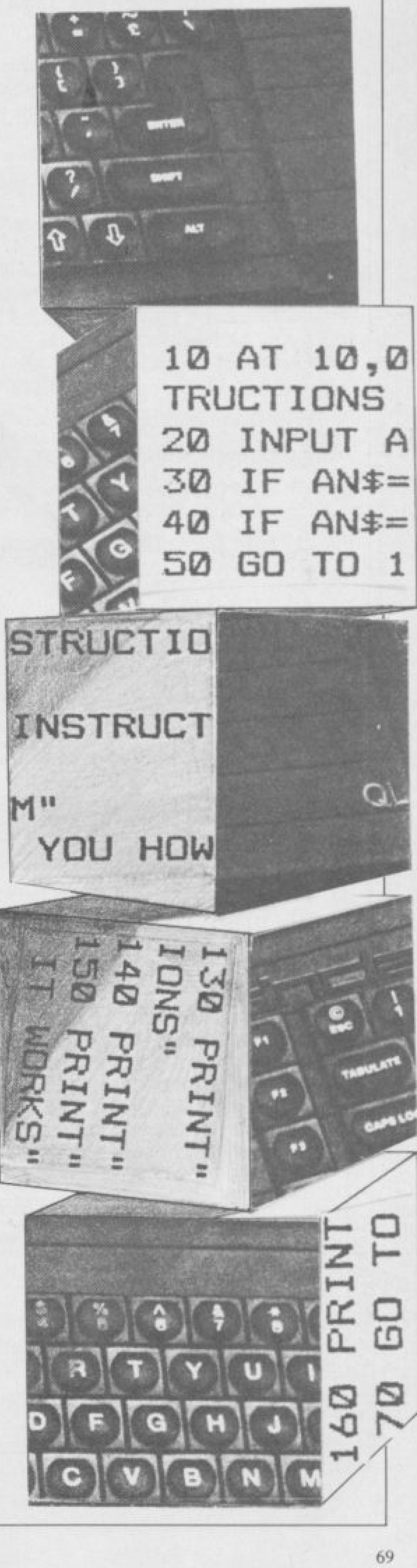
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The first rough draft of the program would look like this:

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continued on page 71

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4. Print out the instructions on the screen. Then, return to 2 in case the user wants to see them again.

The tasks need not have been set out as they are in this example. The instructions could have been the second task and the main part of the program the third. It is a good idea to put the most important part of the program first, however, because they are handier to access when you ask for a LIST.

You can now expand on each of the tasks to see what instructions are needed to make the program work.

Section one is easy; you will need the instructions AT and PRINT in order to display the title.

In section two you will need an INPUT statement to ask whether instructions are needed, and a series of three IF statements to see what answer has been returned.

The third section requires just the PRINT statement in order to display the information which is set out in the main core of the program. The AT instruction may also be used if you want to display different paarts of the text in different places on the screen.

Section four is almost the same as the third, main core, section of the program. It only requires the PRINT command and also, perhaps a couple of PRINT separators.

So, PRINT, AT and IF are the only statements required within the program. You can now start to build up each of the subroutines to suit the sections which you have listed.

The best way to plan subroutines is to start them in blocks, each block beginning with a line number which is a multiple of a thousand.

The first subroutine is to be used for the title page.

```
1000 REMark * TITLE
1010 CLS
1020 AT 50,50
1030 PRINT"THE TITLE"
1040 PAUSE 5*50
1050 RETurn
```

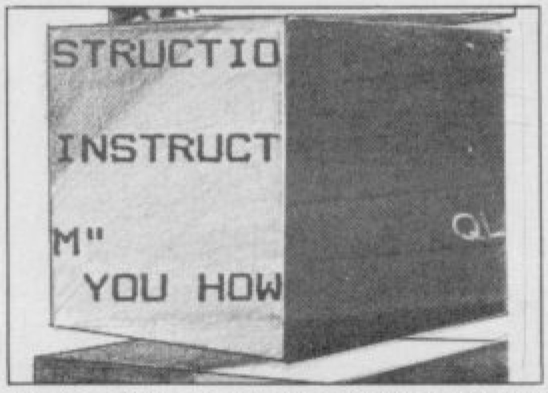
Everything within this listing should be familiar except for one instruction which is located on the last line, 1050. That is the end of the subroutine and the RETURN instruction tells the computer to return to the task which it was performing before it was called to perform the INSTRUCTIONS subroutine.

The next subroutine should ask whether instructions are required by the user. It follows the numbering system of the program and starts at 2000 with a REM statement.

```
2000 REMark * ASK IF INSTRUCTION
S ARE NECESSARY
2010 CLS
2020 AT 10,0
2030 PRINT "ARE INSTRUCTIONS REQ
UIRED (Y/N)?"
2040 INPUT INST$
2050 IF INST$="Y" THEN LET REC=1
2060 IF INST$="N" THEN LET REC=0
2070 RETurn
```

The RETURN command is used again to make the computer go back to the instruction which it was to perform next before it was called away to run the subroutine.

An interesting technique has been used in order that the QL can tell whether instructions are needed when it returns to its next task. A reply is required from the user and it is put into a string variable called INST$. If the reply is 'Y' for 'yes' then the variable REC will contain the number



'1', but if the answer is 'N' for 'no' the REC variable will contain 'O'.

Later the computer will be made to decide whether a yes or no answer has been given by looking at those values.

The next subroutine is the one which provides the instructions if they are needed.

```
3000 REMark * INSTRUCTIONS
3010 CLS: AT 0,10
3020 PRINT"INSTTRUCTIONS"
3030 PRINT\\"THESE ARE THE INSTR
UCTIONS"
3040 PRINT"FOR THE PROGRAM"
3050 PRINT"THEY WILL TELL YOU HO
W IT WORKS"
3060 PAUSE 10*50
3070 RETurn
```

There is nothing very magical about this program. It will print out the title INSTRUCTIONS at 0,10 on the screen followed by the main text which appears three lines down from the headline.

The position of the instructions has changed and it varies from the plan which was drawn up before. The reason for that is to show the versatility of programming using subroutines. You can put them anywhere in the program without altering anything else.

The routine will then make the computer pause for a few seconds, giving the user time enough to read the instructions, and then RETURN to what it was doing before it was interrupted.

The main part of the program forms the next subroutine. In the example it is just five lines of text but it could be anything from calculations to an arcade or adventure game.

```
4000 REMark * MAIN CORE
4010 CLS
4020 PRINT"THIS IS THE MAIN CORE
"
4030 PRINT"OF THE PROGRAM IN WHI
CH"
4040 PRINT"ALL OF THE INFORMATIO
N IS"
4050 PRINT"PROCESSED."
4060 PRINT"IT FINISHES HERE."
4070 PAUSE 10*50
4080 RETurn
```

That is the last of the subroutines but it is not the end of the program or the last piece of code which you have to write in order to get it working.

Lines 10 to 1000 have not been used. That is because a block of lines has to be inserted at the start of the program.

In order to use subroutines you have to call them and that is done by using the GOSUB instruction. GOSUB is like GOTO. The statement has a line number after it and it is to this line the computer goes in order to execute the instructions there.

When it encounters the RETURN statement it knows the subroutine has finished and returns to execute the next line in the program.

In the case of the above program all that is needed to tie the subroutines together and get them working one after the other is to include GOSUB instructions and a series of IF . . . THEN statements to see if the user wants to see some instructions.

```
10 GO SUB 1000:REMark *TITLE
20 GO SUB 2000:REMark *WANT INST
RUCTIONS
30 IF REC=1 THEN GO SUB 3000:REM
ark * IF INSTRUCTIONS NEEDED GO
SUBROUTINE 3000
40 GO SUB 4000:REMark * MAIN COR
E
50 GO TO 5000
```

Above is the control program, it calls all the subroutines, except of course the instructions which are called only if the condition in line 30 is met. The QL will go through each routine, one at a time, and go back to the control routine after it has executed one.

Line 50 tells the QL that once it has finished the program it should jump to the last line which is a REM state-

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ment.

The REM is put at line 5000, but you could include a subroutine telling the user that the program has finished. All you would need to do is to put another GOSUB instruction on line 50 instead of the GOTO.

GOSUB

The power of the GOSUB statement and its counterpart RETURN is obvious and for the most part it can be substituted for the GOTO instruction.

SuperBASIC contains instructions such as GOTO because other computers use them. The BBC Micro has a language similar to that of the QL, so the listings written for it will be easiest to copy.

Of course, it would be foolish to ban the use of GOTO, advocating instead GOSUB. If you cannot find a better way of writing a particular program then you might have to use it. GOSUB should, however, be used as much as possible. It is the more powerful instruction and is the mark of a good programmer.

Using procedures

A procedure is like a subroutine in many respects. It is a separate section within a program and it can be called from another part of a program. It can be called using its name and does not require a command prefix. You do, however, have to tell the QL where a procedure starts and what its task is. This is called defining.

In order to define a procedure the statement

DEFine PROCedure

is used. The name of the procedure follows the word PROCedure. For instance, you may want to call a procedure Calculus, so you would define it with

DEFine PROCedure Calculus

The name must consist of one word and two will be regarded by the QL as an error.

If you wanted to add a procedure to a program to calculate the percentage of a number, which would be entered within the procedure, you would first define it with the name percent:

10 DEFine PROCedure PERcentage

You can then enter the lines of the program which will find your percentage:

```
20 CLS
30 PRINT"PLEASE ENTER THE TOTAL
FIRST"
40 INPUT NUM1
50 PRINT"PLEASE ENTER THE PERCEN
TAGE"\"YOU WANT TO FIND OF THAT
NUMBER"
60 INPUT NUM2
70 PERCENT=(NUM2/100)*NUM1
80 PAUSE 1*50
90 CLS
100 AT 10,10:PRINTNUM2!"PERCENT
OF"!NUM!"IS"!PERCENT
```

Just as you had to use RETURN in order to finish a subroutine so you need to use a terminating statement with a procedure:

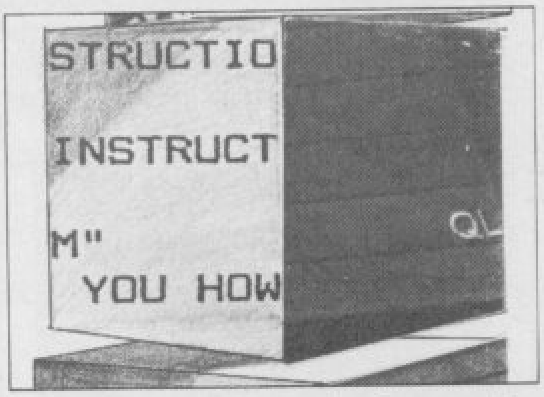
END DEFine

Executing procedures

To invoke a procedure you must type its name. In the program above you would have to add the line

110 PERcentage

The procedure is very much like the subroutine but it is more versatile.



You can use a subroutine by running part of a program but you can use a procedure in immediate mode without running a program. You must, however, have some SuperBASIC lines in order to tell the QL that there are some procedures there.

You might have the series of lines which make up the subroutine PERcentage within the QL. All you have to do to make the procedure work is to type its name.

If you have several procedures set up within a SuperBASIC program you could use each as a small program. You could RUN one by typing its name in immediate mode. The two procedures below will ask you for different input in different ways.

```
10 DEFine PROCedure NUMERIC
20 INPUT"ENTER A NUMBER"!NUM
30 IF NUM <5 THEN PRINT"THAT'S T
OO SMALL"
40 IF NUM>5 THEN PRINT "THAT'S T
OO BIG"
50 IF NUM=5 THEN PRINT "THAT'S J
UST RIGHT"
60 END DEFine NUMERIC
70 DEFine PROCedure CHARACTER
80 INPUT"ENTER A CHARACTER"!CHAR
$
90 PRINT "THE CHARACTER WAS"!CHA
R$
100 END DEFine CHARACTER
```

Do not run the program. Just type in one of the procedure names, NUMERIC or CHARACTER, and you will be asked for relevant input.

Local but variable

Both numeric and string variables can be used in procedures those variables can be created within the main body of the program.

There will be occasions when you might want to use the name of a variable which you have defined in the main body of the program but change the value in a procedure. You might, however, want the value of the original variable to remain the same.

You will know that, because of the way the QL identifies variables, you cannot have two with the same name in the same program. You can, however, give two variables the same name if you apply a special condition to the one in the procedure.

It is possible to make the one in the procedure a temporary variable whose effect is only limited or local to the procedure in which it is situated.

You may start your program with the lines

```
10 ANSWER$="YES"
20 PRINT ANSWER$
30 ANSWER$="NO"
40 PRINT;!ANSWER$
```

You have changed the value of the string variable ANSWER$ but you may want to keep the string 'NO' even though you are going to use the same variable name in the procedure which you to invoke on line 50:

50 USER

The procedure is a simple one:

```
60 DEFine PROCedure USER
70 LOCal ANSWER$
80 INPUT ANSWER$
90 PRINT\\"YOUR ANSWER IS"!ANSWE
R$
100 END DEFine USER
```

In the procedure USER the QL is informed that a local variable is to be set up. The instruction, LOCAL, in line 70 tells the computer which variable is to be called and then it can be set up in the line 80 when the user INPUTS a response.

The response is printed using line 90 and the procedure ends at line 100. As soon as the procedure has finished the computer will go to the instruction after the procedure call which, in this case, is line 110:

110 CLS: PRINT"THE VARIABLE"!ANSWER$ \ "IS STILL THERE"

The computer has forgotten the ANSWER$ variable set up in the procedure and has reinstated the former value which is 'NO'.

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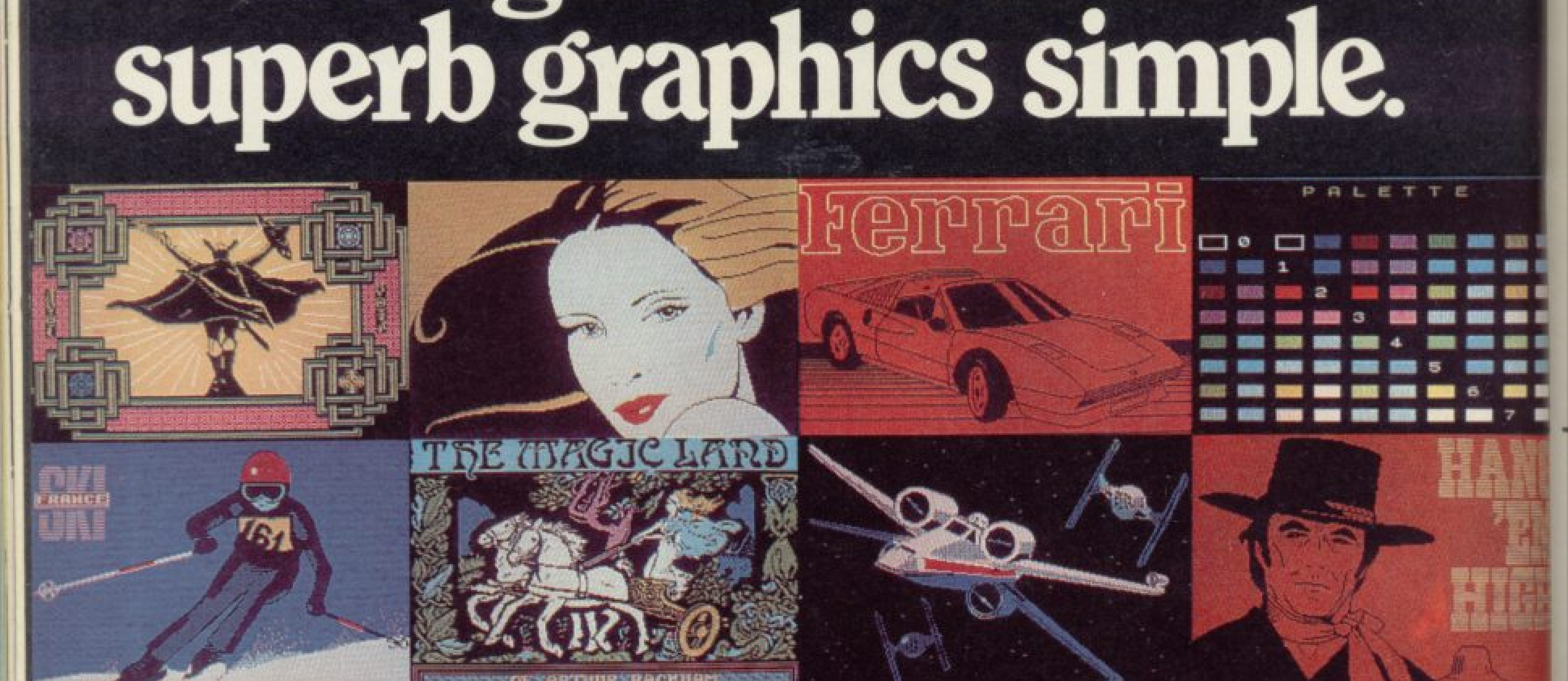
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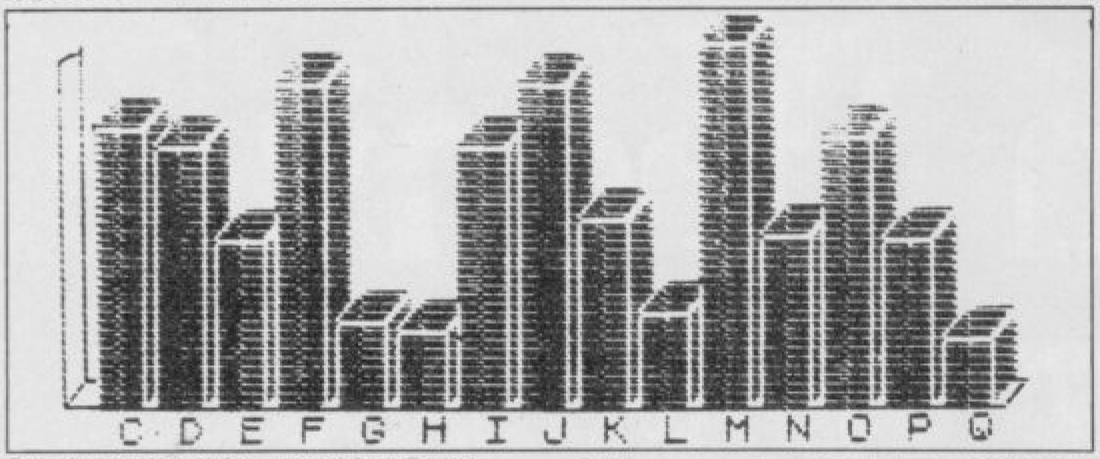


Mini Office

BUSINESS software has always tended to be more expensive than games software, partly because fewer copies are sold and partly because the development time is greater. So when someone offers you a complete office automation system with word processor, spreadsheet, database and graphics program for £5.95 you believe in 28 day delivery periods again.

With the release of **Mini Office** for the 48K Spectrum, Database Publications has done exactly that. What is, perhaps, more surprising is that the package represents excellent value for money. The individual programs are not the best you can buy, nor are they likely to tempt the serious user — indeed, you would not expect that. What they do provide is a good, simple introduction to office automation either for the classroom, or for the new user.

The **word processor** offers two typefaces and two character sizes — normal and double-sized. One menu, which also acts as a return point for any illegal entry, runs the program.



Bar chart produced from spreadsheet figures

The usual range of print, save, load, and verify options for text files is also offered. Left and right margins can be set prior to printing, as can the number of characters per line — up to 32 — and the number of lines per page.

Other facilities include tab stops, page end markers and copy. The last facility copies a letter at a time and is slower than a block copy but because of the way it has been implemented — only the starting point for the move is defined — it is nevertheless effective.

Excellent use of colour helps to distinguish between text which has been typed in and information, such as the number of words and the amount of free space for text.

The **database** is a much scaled down version. The first thing you notice is its limitations; a maximum of 12 fields with up to 21 characters in each. Using all of those would leave room for only 75 records. Fields can be either numeric or string, but numeric fields are really only useful in searches. Those can be performed for any sequence of characters in a string field, or for values equal to, less than, greater than or between two values.

Although a replace function allows all or parts of fields to be replaced, it is limited — at least with part of a field — to replacing the same number of characters. The database can also be sorted on up to four fields.

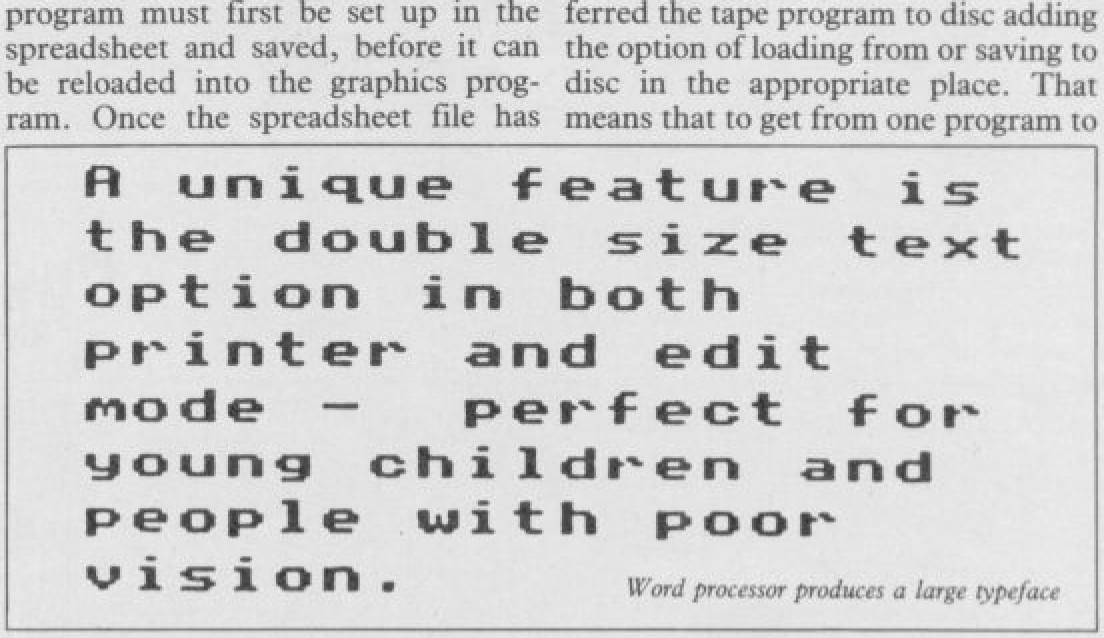
The **spreadsheet** contains most of the necessary elements. Formulae can be used to link boxes, and can also be copied from one box to another, updating for the new row or column in the process. Although the first row and column are reserved for labels of up to eight characters, those labels are not used to define rows or columns. One useful function brings back the previous number in the box. A major restriction is the size of the sheet, which can only extend to a maximum of 30 rows by 20 columns.

The **graphics** program is, perhaps, the most disappointing. Data for the program must first be set up in the spreadsheet and saved, before it can be reloaded into the graphics program. Once the spreadsheet file has been loaded, the row and then the individual columns of data to be used must be specified. An option does exist to change those to any other in the spreadsheet at any time.



Histograms, line graphs and pie charts can all be drawn. The histograms and line charts are both drawn to include negative values and in all cases the columns are referred to by their letters — A, B, C . . . and so on — rather than their labels. There is no method of altering any piece of data from within the program.

A version of **Mini Office** is being released on the Opus Discovery disc system. Unfortunately, Database Publications seems to have simply transferred the tape program to disc adding the option of loading from or saving to disc in the appropriate place. That means that to get from one program to



Word processor produces a large typeface



another — except from graphics to spreadsheet — the unit has to be switched off and the disc reloaded. Other routines which are usually a standard feature of disc-based software — such as the ability to list the files on a disc from within the programs — have also been omitted.

It is impossible to recommend **Mini Office** if you are looking for a complete working system unless finance precludes buying the best individual programs — **Tasword II** the word-processor, **Masterfile** the database, **Omnicalc** the spreadsheet and **Projector 1** for the business graphics program. However, if you are looking for an inexpensive way of learning how a word processor, database and spreadsheet work then it is to be wholeheartedly recommended.

Mike Wright

Mini Office
Database Publications, Europa House, 68 Chester Road, Hazel Grove, Stockport SK7 5NY. Price: **£5.95**



Pie chart drawn with graphics program

Personal Banking System

PERSONAL Banking System, written by Micromega and marketed by Hilton Computer Services Limited is yet another program designed to help you manage your personal accounts using a 48K Spectrum.

Personal Banking System has been available for some time but improvements to the latest version allows the transfer to, and use of, microdrives and 80-column printers. Further improvements include the use of Myrmidon Software's **Microprint** to give 51 characters per line, the speeding up of some routines by using machine code and the provision of an analysis code so that items of income and expenditure can be grouped together.

The program is menu driven by an eight option main menu which offers the usual options of displaying statements, entering new data, saving and loading data, searching for entries and setting standard orders. The other options allow the reconciliation of bank statements, system maintainence and a forward/back value option used to make changes to data or calculate a forward projection.

Entries can be made in a new calendar year only if an entry has already been made for December. To make data entry easier the amount is entered in pence, omitting the decimal point.

Regular payments can be handled automatically using the standing order option. The frequency, number of the payments, starting date, as well as the usual entry details of up to 10 standing orders, can be set. The standing orders are then checked and applied, if appropriate, every time an entry is made.

Reconciliation of entries with a bank statement is a common feature but PBS goes one stage further in that bank statements are entered separately. The items are compared against the PBS data and discrepancies divided into types — uncleared cheques and unmatched items, either with a PBS entry or a statement entry. The program can show those items which are similar and could be the same except for an error.

Compared to OCP's **Finance Manager** I found PBS slow, especially when searching for items. Although it has clear, informative screen displays and is an excellent program I still have reservations. Despite my carping, this would figure in any list of recommended programs, and is well worth considering if you are looking for a program to manage your home finances.

Mike Wright

Personal Banking System
Hilton Computer Services, 14 Avalon Road, Orpington, Kent BR6 9AX
Price: **£9.95**

UNISTAT

FOR MANY years University Software has provided a range of high quality statistical programs for the Spectrum and ZX-81. Improved and revised versions of two of those — **Statistics** and **Super-Regression** — are now available for the 48K Spectrum as **UNISTAT,** a general purpose statistical package.

It contains cassette and microdrive versions of the programs and is priced at £60.00. The package is aimed at statisticians and students of statistics.

The package contains options to generate all the statistics, statistical tests, distributions and diagrams most users are likely to need. The multivariate regression program will cope with exponential and geometric equations as well as the more usual linear equations.

The cartridge version allows the use of one or two microdrives and a full-sized printer with an RS232 interface, but no allowance has been made for Centronics interfaces.

About 2500 pieces of data can be handled but that is reflected in the poor error-trapping which are only partly due to the programs being written in Basic. They are also slow when handling large amounts of data. Menus are cramped into the bottom few lines of the screen with several options per line. However, if you are going to use the Spectrum for statistical work then **UNISTAT** offers the most complete package available.

Mike Wright

UNISTAT
University Software, 29 St Peter's Street, London N1 8JP
Price: **£60.00**

TRANSFORM LTD. Business Software

Are you taking your Spectrum seriously?



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The Transform Keyboard transforms your Spectrum into a fully operational professional machine.

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SINCLAIR USER JUNE 1984

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Business Bank Account £10.75
This program will enable you to enter debits under 17 different subheadings. Statements include totals of all subheadings.

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For all your invoices, this program will enable you to prepare statements of outstanding invoices. Program will also calculate VAT.

Purchase Day Book £10.75
Keeps a complete record of all your purchases under 17 different subheadings. This program also calculates VAT.

Business Pack £25.00
Including all the above programs.

Stock Control £10.75
Handles 900 lines, including details of supplier. Program has full search facilities enabling you to search and update all lines from one supplier.

Invoicing £15.00
This program will print out invoices, calculates discounts and VAT. The program will calculate totals from unit prices. Up to 50 accounts with 250 outstanding invoices.

Word Processing by Tasman **£13.90**
Tasword Two is a powerful word processing program that will perform all the functions available on large processors. The program will give you 64 characters per line on screen.

Masterfile by Campbell Systems **£15.00**
This is one of the best database programs available for the ZX Spectrum. This program has many uses in a small business.

Dlan by Campbell Systems **£7.95**
Use your Spectrum to sell your products. Dlan will display messages in up to 11 different typefaces. Will scroll text in any direction.

64 Column Generator by Tasman **£5.50**
You can use this program within your other programs to display 64 columns on screen.

Payroll by Byte One **£19.95**
This payroll program will handle up to 40 employees and will calculate NIC, PAYE, superannuation and many other deductions. This is a very user friendly program and extremely good value.

NEW

Sales/Purchase Ledger Invoicing £25.00
This program is for use on micro-drive only. The program will print an invoice using a built-in price list and post the invoice to your customer's account. Will also print price lists, statements, labels etc.

Tasmerge £10.95
Allows you to transfer data from Masterfile into Tasword enabling you to use Tasword for mail merge. The program allows you to specify line and column of each field. For use on micro-drive only.

Superfile £14.95
This is a new database program that stores pages of text 64 columns x 22 rows. The program includes word processing and full search facilities.

Omnicalc 2 £14.95
This is the long-awaited micro-drive version of omnicalc complete with histograms and many other features.

Projector 1 £13.90
Business graphics program that will help you present your cashflow, sales expenditure in many different ways including pie line, and histogram charts.

Tasprint £9.90
Use this program with Tasword Two to produce 5 different fonts on a dot matrix printer.

MF-Print £6.95
Enables you to set a print format for your full-size printer within masterfile. Supplied complete with masterfile for **£19.95**.

Trans Express £9.95
Micro-drive utility program which will enable you to backup all your micro-drive cartridges.

Now in stock

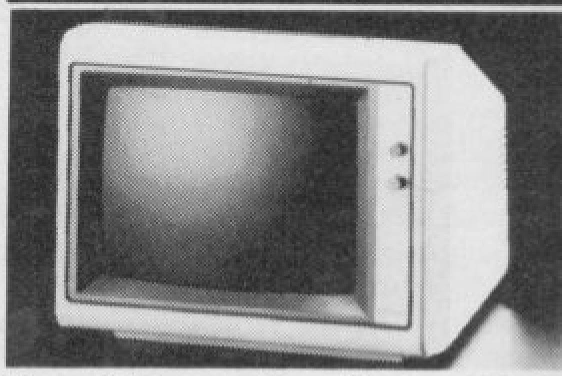
Blank micro-drive cartridges	£4.95
Continuous paper	£12.99
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QL

Centronics Interface	£39.95
QL Dust Cover	£5.00

Transform can supply a wide range of printers, monitors, and leads for the QL. For further details send S.A.E.

Monitors



It is possible to connect your Spectrum to both Black/Green and composite Video monitors using high resolution monitors are particularly useful with programs like Tasword that use 64 columns. We supply complete instructions on how to connect monitors to both Issue Two and Issue Three Spectrums. These monitors can also be connected to your QL.

Phillips black and green	£75.00
Kaga/Taxan black and green	£99.95
Sanyo Med res for QL	£273.60

Printers

All the software we supply runs on full-size printers (unless you are using interface 1) you will require an interface to connect your Spectrum to a printer, the interface we supply uses the graphics characters to set printer codes as in Tasword and prints a double size screen dump.

Centronics/RS232 Interface	£45.00
Dot matrix printers	
Brother HR5	£132.00
Brother M1009	£163.00
Star Gemini 10x	£199.00
Epson RX80 FT	£229.00
Epson FX80	£324.00
Daisywheel printers	
Smith-Corona TP I	£189.00
Silver Reed EXP500	£284.00
Brother HR15	£349.44

Please add **£5.00** delivery plus VAT to the price of printers and monitors. All software prices include VAT, post and packing.

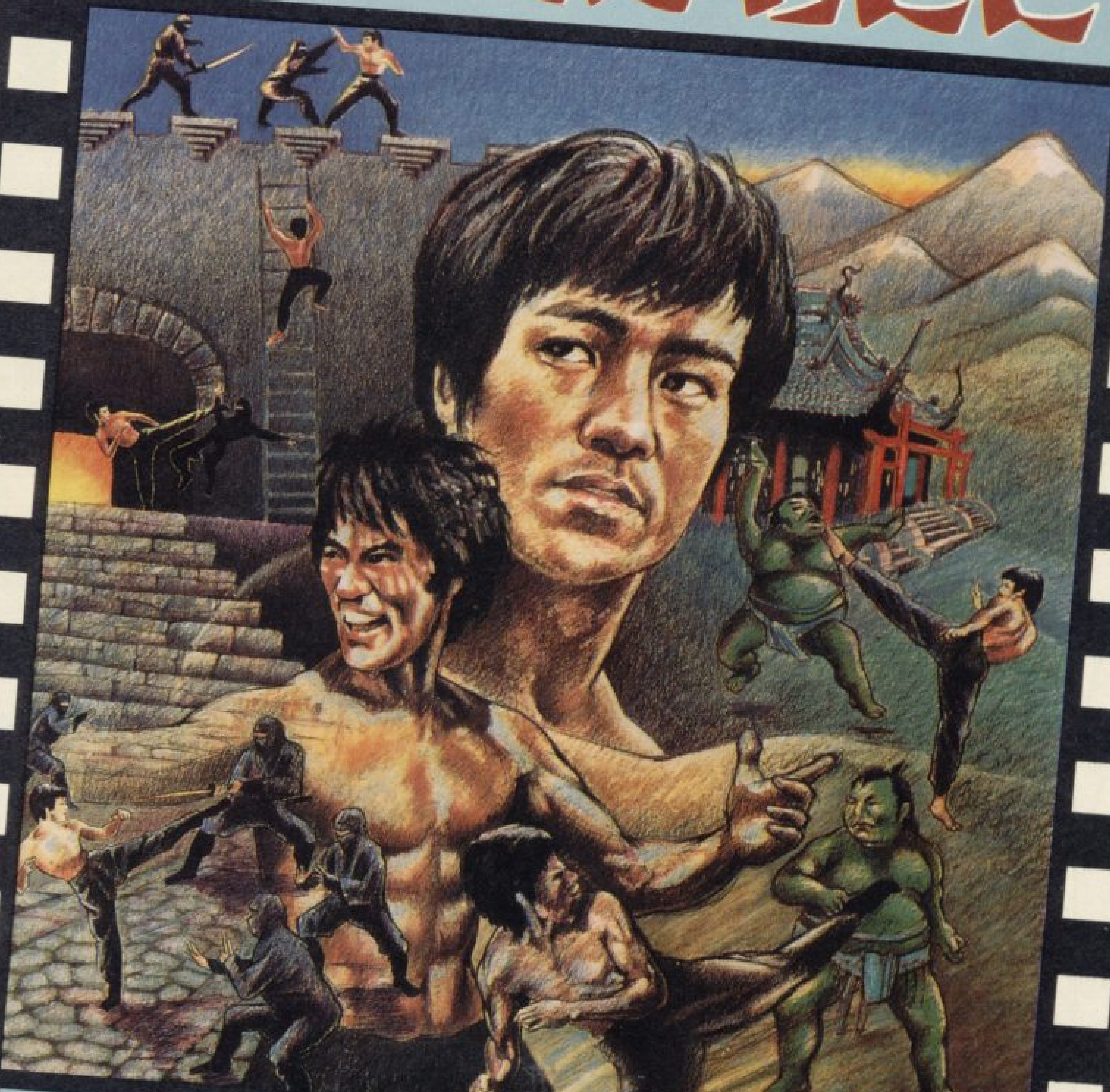
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MSX · TATUNG EINSTEIN · ZX SPECTRUM · SINCLAIR QL · AMSTRAD CPC 464

Thinking so ...thi

THE TASWORD WORD PROCESSORS

The extensive features of the Tasword word processors are ideal for both the home and business user. Every Tasword comes complete with a comprehensive manual and a cassette or disc. The cassette or disc contains your TASWORD and TASWORD TUTOR. This teaches you word processing using TASWORD. Whether you have serious applications or simply want to learn about word processing, TASWORD and TASWORD TUTOR make it easy and enjoyable.

TASWORD TWO (Spectrum)

64 characters per line on the screen!

"Without doubt, the best utility I have reviewed for the Spectrum." HOME COMPUTING WEEKLY APRIL 1984

"If you have been looking for a word processor, then look no further." CRASH JUNE 1984

The cassette program is supplied with instructions for microdrive conversion.

TASWORD TWO* ZX 48K Spectrum
cassette **£13.90**
microdrive cartridge **£15.40**

TASWORD 464

"There is no better justification for buying a 464 than this program."
POPULAR COMPUTING WEEKLY NOVEMBER 1984

A particularly sophisticated yet easy to use program. Now available on disc. The cassette version is supplied with instructions for transferring to disc.

TASWORD 464* Amstrad CPC 464
cassette **£19.95**
disc **£22.95**

TASWORD EINSTEIN

A sixty-four character per line display and the ability to hold over five hundred lines of text at any time are just some of the features of this, the most recent, of the Taswords. Full interaction with the disc system – e.g. Tasword detects the presence of added drives and allows their use.

TASWORD EINSTEIN Tatung Einstein
disc **£19.95**

TASWORD MSX

With all the features of the Spectrum Tasword Two including the amazing sixty four character per line display. The Tasword MSX machine code program utilises the 32K of memory not normally available to Basic allowing over five hundred lines of text to be held in memory.

TASWORD MSX* 64K MSX Computers
Fully inclusive mail order price **£13.90**

(cassette includes both disc and tape versions)

THE TASCOPY SCREEN COPIERS

The TASCOPY screen copiers print high resolution screen copies with different dot densities and patterns for the various screen colours. This gives the screen copies a shaded effect which presents on a monochrome scale the colours on the screen. With TASCOPY you can keep a permanent and impressive record of your screen pictures and diagrams. TASCOPY supports all the printers mentioned under TASPRINT.

TASCOPY (Spectrum + Interface 1)

The Spectrum TASCOPY is for use with the RS232 output on ZX Interface 1. It produces monochrome copies (in a choice of two sizes) as well as copies with the shaded "grey scale" effect described above.

TASCOPY ZX Spectrum
cassette **£9.90**
microdrive cartridge **£11.40**

TASCOPY 464

Adds two new commands to the 464 Basic to give both a standard shaded screen copy as well as a "poster size" copy which is printed onto two or four sheets which can be cut and joined to make the poster.

TASCOPY 464 Amstrad CPC 464
cassette **£9.90**
disc **£12.90**

TASCOPY QL

TASCOPY QL adds new commands to QL Superbasic. Execute these commands to print a shaded copy of the screen contents. Print the entire screen or just a specified window. TASCOPY QL also produces large "poster size" screen copies on more than one sheet of paper which can then be cut and joined to make the poster, and high speed small copies.

TASCOPY QL Sinclair QL
microdrive cartridge **£12.90**

THE TASPRINT STYLE WRITERS

A must for dot-matrix printer owners! Print your program output and listings in a choice of five impressive print styles. The Tasprints utilise the graphics capabilities of dot matrix printers to form, with a double pass of the printhead, output in a range of five fonts varying from the futuristic data-run to the hand writing simulation of Palace Script. A TASPRINT gives your output originality and style! The TASPRINTS drive all Epson compatible eight pin dot-matrix printers, e.g.

- AMSTRAD DMP 1
- EPSON FX-80
- EPSON RX-80
- EPSON MX-80 TYPE III
- NEC PC-8023B-N
- MANNESMANN TALLY MT-80
- STAR DMP 501/515
- BROTHER HR5
- SHINWA CP-80
- COSMOS-80
- DATAC PANTHER
- DATAC PANTHER II

Five impressive print styles for your use:-

COMPACTA – bold and heavy, good for emphasis
DATA-RUN → A FUTURISTIC SCRIPT
LECTURA – clean and pleasing to read
MEDIAN – a serious business-like script
Palace Script – a distinctive flowing font

Typical Tasprint output. Please note that different makes of printer produce different sized output.

TASPRINT (Spectrum)

Drives all the printer interfaces compatible with TASWORD TWO and can be used to print TASWORD TWO text files as well as output from your own Basic programs.

TASPRINT 48K Spectrum
cassette **£9.90**
microdrive cartridge **£11.40**

TASPRINT 464

Can be used to print AMSWORD/TASWORD 464 text files in addition to output from your own Basic programs. Drives the Amstrad DMP 1 in addition to the printers listed to the left.

TASPRINT 464 Amstrad CPC 464
cassette **£9.90**
disc **£12.90**

TASPRINT QL

TASPRINT QL includes a screen editor used to modify files created by other commercial software, such as QUILL, or by the user from BASIC. These modified files include TASPRINT control characters and may be printed, using TASPRINT, in one or more of the unique TASPRINT fonts.

TASPRINT QL Sinclair QL
microdrive cartridge **£19.95**

THE SMASH HIT COMPUTER GAMES PACK



PROGRAM PRINTOUT

GRAPHICS INSTRUCTIONS

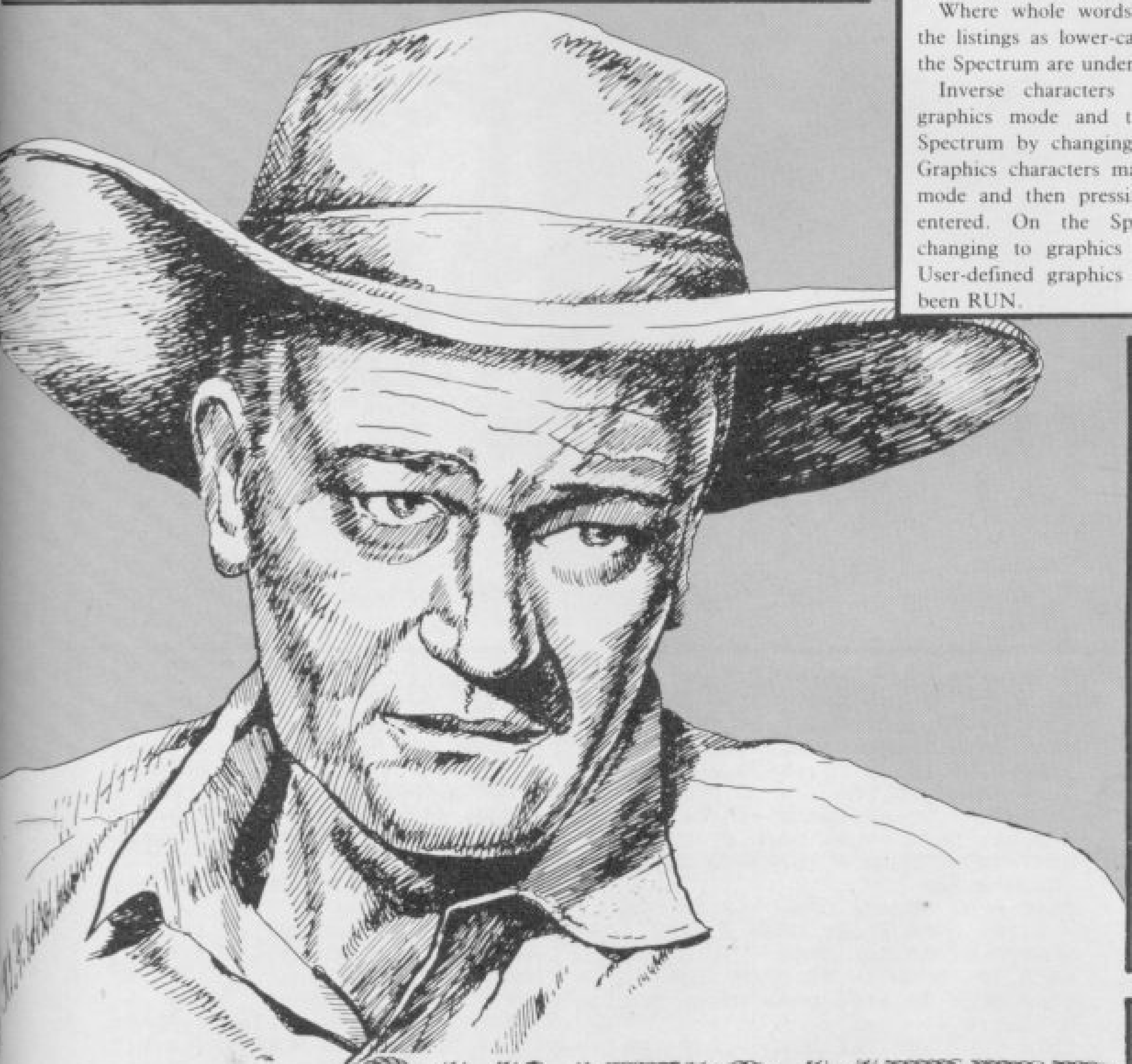
Instructions for graphics characters are printed in lower-case letters in our listings. They are enclosed by brackets and separated by colons to distinguish them and the brackets and colons should not be entered.

Inverse characters are represented by the letter "i" and graphics characters by "g". Thus an inverse W would be represented by "iw", a graphics W by "gw", and an inverse graphics W by "igw".

Spaces are represented by "sp" and inverse spaces by "isp". Whenever any character is to be used more than once, the number of times it is to be used is shown before it, together with a multiplication sign. Thus "6*isp" means six inverse spaces and "(g4:4*i4:g3)" would be entered as a graphic four, followed by an inverse four repeated four times, followed by a graphics three. Control codes appear with cc before the appropriate key. They are obtained by pressing Caps Shift while in Extended mode.

Where whole words are to be written in inverse letters they appear in the listings as lower-case letters. Letters to be entered in graphics mode on the Spectrum are underlined.

Inverse characters may be entered on the ZX-81 by changing to graphics mode and then typing the appropriate characters and on the Spectrum by changing to inverse video and typing the appropriate letters. Graphics characters may be entered on the ZX-81 by changing to graphics mode and then pressing symbol shift while the appropriate characters are entered. On the Spectrum graphics characters may be obtained by changing to graphics mode and then pressing the appropriate character. User-defined graphics will appear as normal letters until the program has been RUN.



JOHN WAYNE lives again in **Gunfighter** by Mark Hinchcliffe of Aberdeen. You must eliminate the Boot Hill Gang, who are holed up on a farm outside town. The gang members appear from behind cover and you must train your sights on them before they get you.

Gunfighter runs on the 48K Spectrum and contains two machine code routines. One scans the keyboard and allows you to fire on the move, the other produces the sound effects.

The program uses our special abbreviations for graphics characters, so please read the instructions above before entering the listing.

```
   1 REM *******GUNFIGHT*******
by Mark Hinchcliffe
   5 CLEAR 38990
  10 BORDER 0: PAPER 6: CLS
  30 PRINT  INK 1; PAPER 5;AT 5,
10;"PLEASE WAIT";AT 6,11;"A MOME
NT"
  40 GO TO 5000
 100 POKE 40000,16: POKE 40001,1
0: PRINT  OVER 1;AT 10,16;CHR$ 1
44
 110 RANDOMIZE USR 39000
 120 GO SUB (con*10)+2000
 124 REM Fire routine
 125 IF f=1 THEN  GO SUB 1000: G
O TO 110
 130 IF PEEK 40010=1 THEN  LET y
=PEEK 40000: LET x=PEEK 40001: G
O SUB 500: LET f=1: PRINT  OVER
1; PAPER 6; INK 2;AT x,y;CHR$ 15
0: RANDOMIZE USR 39165: GO TO 14
0
 135 GO TO 110
 140 LET shots=shots-1
 150 IF shots<12 THEN  PRINT  PA
PER 7;AT 20,(6+shots);"(sp)"
 160 IF shots>11 THEN  PRINT  PA
PER 7;AT 21,(shots-6);"(sp)"
 170 GO SUB 500: GO SUB 1000
 180 GO TO 110
 500 PLOT 135,16: DRAW  OVER 1;(
(PEEK 40000)*8)-131,155-((PEEK 4
0001)*8)
 510 RETURN
 999 REM Gunfighter hit?
1000 IF x=xx AND y=yy AND con=3
THEN  GO SUB 3000: GO TO 1040
1005 IF x=xx+1 AND y=yy AND con=
3 AND d=149 THEN  GO SUB 3000: G
O TO 1040
1010 PRINT  OVER 1; INK 0; PAPER
 6;AT x,y;CHR$ 150: LET f=0: POK
E 40010,0
1015 IF hit=10 THEN  GO TO 8000
1020 IF shots=0 AND con=3 THEN
GO SUB 3000: GO TO 8600
1025 IF shots=0 THEN  GO TO 8600
1030 RETURN
1040 LET sc=sc+((INT (300/t))+1)
*100: LET con=0: LET t=0: LET hi
t=hit+1: PRINT #1; PAPER 7; INK
0;AT 1,(hit+5);CHR$ 146: PRINT
PAPER 7;AT 21,26;sc: GO TO 1010
1999 REM Gunfighter timing
2000 RANDOMIZE : LET del=INT (RN
D*100)+150/lev: LET con=1
2005 LET r=INT (RND*12)+1: LET x
x=a(r,1): LET yy=a(r,2): LET c=a
(r,3): LET d=a(r,4)
2010 LET t=t+1: IF t=del THEN  L
ET con=2: LET t=0: GO SUB 3000:
BEEP .05,xx
2015 RETURN
2020 LET del=INT (RND*(60/lev))+
90/lev: LET con=3
2029 REM Sheriff hit?
2030 LET t=t+1: IF t=del THEN  L
ET con=0: LET t=0: RANDOMIZE USR
 39165: GO SUB 3000: LET h=INT (
RND*(4-lev))+1
2040 IF h=1 THEN  FOR n=7 TO 0 S
TEP -1: OUT 254,n: PAUSE 2: NEXT
 n: LET lives=lives-1: PRINT #1;
 PAPER 7;AT 1,(26+lives);"(sp)":
 PRINT  PAPER 6;AT 0,0;"(sp)": L
ET h=0
2050 IF lives=0 THEN  GO TO 8300
2060 RETURN
2999 REM Print gunfighter
3000 PRINT  OVER 1; PAPER 6;AT x
x,yy;CHR$ c;AT (xx+1),yy;CHR$ d
3010 RETURN
4999 REM UDG'S
5000 FOR n=0 TO 95
```

continued on page 86



continued from page 85

```
5010 READ a
5020 POKE (65368+n),a
5030 DATA 24,24,0,195,195,0,24,2
4,0,24,60,60,60,60,60,126,24,24,
126,24,24,60,126,0
5040 DATA 16,16,56,84,84,40,40,1
08,24,60,24,24,60,90,153,153,153
,60,60,102,102,102,102,231,132,1
08,127,62,124,124,150,1
5050 DATA 60,66,165,153,153,165,
66,60,56,70,161,149,161,171,69,8
2,66,36,36,36,36,37,35,34
5060 DATA 36,36,36,36,36,36,66,1
29,69,170,178,146,146,146,146,14
6
5070 NEXT n
5099 REM Gunsight control/Gunsho
t
5100 FOR n=0 TO 187
5110 READ a
5120 POKE (39000+n),a
5130 DATA 237,75,64,156,62,247,2
11,255,219,254,230,16,194,119,15
2,58,64,156,38,0,188,202,143,152
,61,50,64,156,195,143,152
5140 DATA 62,239,211,255,219,254
,230,4,194,143,152,58,64,156,38,
31,188,202,143,152,60,50,64,156,
62,239,211,255,219,254,230,8,194
,170
5150 DATA 152,58,65,156,38,0,188
,202,194,152,61,50,65,156,195,19
4,152,62,239,211,255,219,254,230
,16,194,194,152,58,65,156,38,19,
188
5160 DATA 202,194,152,60,50,65,1
56,62,239,211,255,219,254,230,1,
194,210,152,62,1,50,74,156,237,9
1,64,156,62,22,215,120,215,121
5170 DATA 215,62,21,215,62,1,215
,62,144,215,62,22,215,122,215,12
3,215,62,21,215,62,1,215,62,16,2
15,62,0,215,62,144,215,201
5180 DATA 33,0,0,14,0,22,1,126,2
30,24,211,254,65,16,254,35,21,32
,244,12,32,239,201
5190 NEXT n
5299 REM Gunfighter data
5300 DIM a(12,4)
5310 FOR n=1 TO 12: FOR m=1 TO 4
5320 READ a(n,m)
5330 NEXT m: NEXT n
5340 DATA 11,1,148,149,13,6,148,
32,13,9,148,149,17,12,148,149,10
,25,148,32,16,30,148,32,9,22,148
,32,4,29,147,32,2,22,147,32,2,8,
147,32,16,21,148,32,13,12,148,14
9
5399 REM Instructions
5400 CLS : BEEP .2,15
5410 PRINT AT 1,11;"GUNFIGHT"
5420 PRINT AT 5,1;"You are the l
ocal sheriff and";AT 6,1;"your t
own is being terrorized";AT 7,1;
"by the the Boot Hill Gang.";AT
8,1;"You have decided to go to t
heir";AT 9,1;"ranch for a showdo
wn"
5430 PRINT AT 11,1;"Your gunsigh
t is controlled by";AT 12,1;"the
 cursor keys (5,6,7&8) for";AT 1
3,1;"left,down,up and right";AT
14,1;"respectively. The""0""key
fires";AT 15,1;"your gun"
5440 PRINT INK 5; PAPER 1;AT 18
,4;"PRESS ANY KEY TO START"
5450 IF INKEY$="" THEN GO TO 54
50
5460 BEEP .2,15: CLS
5499 REM Draw scene
5500 FOR n=0 TO 31: PRINT AT 17,
n;CHR$ 155;AT 18,n;CHR$ 155: NEX
T n: PRINT AT 17,11;CHR$ 138;CHR
$ 32;CHR$ 133;AT 18,11;CHR$ 138;
CHR$ 32;CHR$ 133
5510 FOR n=0 TO 21: PRINT AT 2,n
;CHR$ 155: NEXT n: PRINT AT 2,8;
CHR$ 32
5515 FOR n=1 TO 17: READ a,b,c:
PRINT AT a,b;CHR$ c: NEXT n
5520 DATA 12,25,151,12,22,151,0,
23,153,0,27,152,0,29,154,1,23,15
4,1,25,152,1,27,153,2,24,152
5525 DATA 2,25,153,2,27,154,2,28
,152,3,24,153,3,25,154,3,28,153,
4,24,154,4,28,154
5530 PLOT 95,56: DRAW -15,0: DRA
W 0,20: DRAW -9,0: DRAW 0,-20: D
RAW -31,0: DRAW 0,40: DRAW 55,0:
 DRAW 0,-40
5540 PLOT 58,63: DRAW -12,0: DRA
W 0,10: DRAW 12,0: DRAW 0,-10
5550 PLOT 40,56: DRAW -24,16: DR
AW 0,40: DRAW 12,4: DRAW 12,-19
5560 PLOT 28,116: DRAW 55,0: DRA
W 12,-19
5570 PLOT 208,76: DRAW -32,0: DR
AW 0,11: DRAW 32,0: DRAW 0,-11
5580 PLOT 176,76: DRAW -12,8: DR
AW 0,11: DRAW 12,-8: DRAW 32,0:
DRAW -12,8: DRAW -32,0
5590 PLOT 196,87: DRAW 0,8: PLOT
 170,82: DRAW -12,-10: PLOT 164,
72: DRAW -6,4
6010 FOR n=0 TO 127: POKE (23168
+n),56: NEXT n
6020 PRINT  PAPER 7;AT 20,1;"AMM
O";AT 20,20;"LEVEL";AT 21,20;"SC
ORE"
6030 PRINT #1; PAPER 7; INK 0;AT
 1,1;"HITS";AT 0,20;"HIGH";AT 1,
20;"LIVES"
6040 LET hs=0
6099 REM Start
6100 PRINT #1; PAPER 7;AT 1,6;"(
10*sp)": FOR n=20 TO 21: FOR m=6
 TO 17: PRINT  INK 1; PAPER 7;AT
 n,m;CHR$ 145: NEXT m: NEXT n
6200 PRINT  INK 1; PAPER 5;AT 5,
7;"(2*sp)SELECT LEVEL(2*sp)";AT
6,9;"(2*sp)(1 TO 3)(2*sp)": BEEP
 .1,10
6210 IF PEEK 23557<>5 THEN  GO T
O 6210
6220 IF PEEK 23560<49 OR PEEK 23
560>51 THEN  GO TO 6210
6230 LET lev=(PEEK 23560)-48
6240 PRINT  PAPER 7;AT 20,26;lev
; PAPER 6;AT 5,7;"(16*sp)";AT 6,
9;"(12*sp)"
6500 LET xx=0: LET yy=0: LET h=0
: LET t=0: LET f=0: LET wo=0: LE
T hit=0: LET sc=0: LET shots=24:
 LET lives=3: LET con=0: PRINT )
1; INK 2; PAPER 7;AT 1,26;CHR$ 1
47;CHR$ 147;CHR$ 147; INK 0;AT 0
,26;hs: PRINT  PAPER 7;AT 21,26;
"0(5*sp)"
6600 FOR n=0 TO 7: READ a,b: BEE
P a,b: NEXT n
6610 DATA .2,16,.2,21,.2,16,.2,2
1,.5,16,.4,12,.45,14,.45,9
6700 GO TO 100
7999 REM End routines
8000 PRINT  FLASH 1; INK 1; PAPE
R 5;AT 5,11;"WELL DONE";AT 6,8;"
!!!Youve won!!!": FOR n=0 TO 10:
 BEEP .05,n: BEEP .05,(n*3): NEX
T n: PAUSE 100
8010 LET sc=sc+1000+(shots*200)+
(lives*500): GO TO 9010
8300 PRINT AT 5,11;"You have";AT
 6,8;"been shot dead": GO TO 890
0
8600 PRINT AT 5,10;"You have no"
;AT 6,9;"bullets left": GO TO 89
00
8900 FOR n=0 TO 10: READ a,b: BE
EP a,b: NEXT n
8910 DATA .45,0,.3,0,.15,0,.45,0
,.3,3,.15,2,.3,2,.15,0,.3,0,.15,
-1,.45,0
9010 PRINT  PAPER 7;AT 21,26;sc
9020 IF sc>hs THEN  LET hs=sc: P
RINT #1; PAPER 7; INK 0;AT 0,26;
hs
9030 PRINT  INK 1; PAPER 5;AT 5,
9;"PRESS ANY KEY";AT 6,8;"  TO C
ONTINUE  "
9040 IF INKEY$="" THEN  GO TO 90
40
9050 PRINT  PAPER 6;AT 5,9;"(13*
sp)";AT 6,8;"(15*sp)": RESTORE 8
910: RESTORE 6610: PRINT  OVER 1
; PAPER 6;AT PEEK 40001,PEEK 400
00;CHR$ 144: POKE 40010,0: GO TO
 6100
```

moon patrol



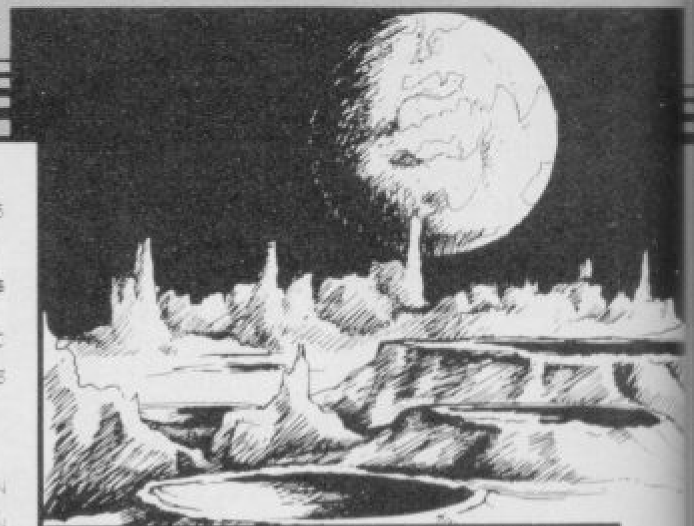
NEGOTIATE the rugged surface of the moon in **Moon Patrol** by Andrew Baxter of Newmarket, Suffolk.

The game, for the 16K ZX-81, uses machine code. Make sure you have the correct number of characters in the REM statements at the beginning. Then follow the following instructions to get a streamlined version of the program.

1 — GOTO 83
2 — BREAK when you see the title screen come up.
3 — Delete lines 7000 to 8740
4 — SAVE a copy
5 — GOSUB 9920, ignoring the error message. If you accidentally type RUN or CLEAR after this point, re-load the copy you SAVEd at step 4 and start again from step 5.
6 — GOSUB 9920, ignoring the error message.
7 — Delete lines 100, 110, 115
8 — Delete lines 9240 to 9980
9 — Prepare the tape recorder for SAVEing.
10 — LET SA=1
11 — GOTO 90. The program will start to SAVE after a short pause.
12 — Stop the tape recorder after the title page is displayed.

```
   1 REM 162 CHARACTERS.......2...
.......3.........4.........5.....
....6.........7.........8........
..9.........0.........1..........
2.........3.........4.........5.
........6..
   2 REM 75 CHARACTERS.......2...
.......3.........4.........5.....
....6.........7.....
   3 REM 88 CHARACTERS.......2...
.......3.........4.........5.....
....6.........7.........8........
.
   4 REM 72 CHARACTERS.......2...
.......3.........4.........5.....
....6.........7..
   5 REM 31 CHARACTERS.......2...
.......3.
   6 REM 37 CHARACTERS.......2...
.......3......
   7 REM 80 CHARACTERS.......2...
.......3.........4.........5.....
....6.........7.........8
  10 REM [illegible]
  12 REM [illegible]
  15 REM [illegible]
  17 REM [illegible]
  80 LET SA=0
  82 GOTO 90
  83 LET SA=0
  85 GOSUB 6000
  87 GOSUB 8110
  90 FAST
 100 GOSUB 9500
 110 GOSUB 9730
 115 GOSUB 9910
 120 GOSUB 9020
 125 GOTO 6000
 130 IF IN=1 THEN GOSUB 1200
 140 GOSUB 2510
 150 GOSUB 4200
 160 GOTO 140
 180 STOP
1120 POKE 16418,0
1130 PRINT AT 3,0;
1140 FOR A=1 TO 10
1142 PRINT B$;B$;
1143 NEXT A
1150 PRINT B$
1160 PRINT AT 0,1;"SCORE:";AT 0,
11;"0 LIVES:";AT 0,22;"HI:";H$(
1);"0"
1165 IF LIVES=3 AND LEVEL=1 AND
SPEED=1 THEN PRINT AT 0,7;"0000"
;AT 0,19;"[illegible]"
1170 PRINT AT 1,3;"    FUEL [illegible]"
1180 PRINT AT 2,0;"[illegible]"
1190 RETURN
1215 PRINT AT 0,0;
1220 FOR A=1 TO 24
1230 PRINT B$;
1240 NEXT A
1250 PRINT AT 0,10;"MOON PATROL"
;AT 1,10;"==========="
1260 LET D$=" MOONBASE GAMMA I
S UNDER3ATTACK. THE [illegible] GUNSHI
PS ARE [illegible] OUTSIDE THE FORCE
DOME. 1SINCE THE COMMUNICATION LI
NK1HAS BEEN DESTROYED, YOU MUST1
SPREAD THE NEWS TO THE OTHER BAS
ES. [illegible] ON [illegible] ACROSS THE UN-
[illegible] LUNAR SURFACE [illegible] MUST TAK
E [illegible]"
1270 LET D$=D$+"TO AVOID CRATER
S2AND ROCKS, YOUR DWINDLING FUEL
SUPPLY CAN BE BOOSTED BY1LANDING
 [illegible]
1280 LET D$=D$+"[illegible]
1290 LET D$=D$+"[illegible]
LEVEL ONE BONUS [illegible]
1300 LET LINES=8
1310 GOSUB 1500
1320 GOSUB 1400
1325 LET D$=D$(2 TO )
1330 LET LINES=8
1335 GOSUB 1595
1340 GOSUB 1500
1345 LET LINES=8
1355 GOSUB 1400
1360 GOSUB 1595
1365 GOSUB 1500
1370 GOSUB 1400
1379 LET LINES=8
1383 GOSUB 1595
1385 GOSUB 1500
1387 GOSUB 1400
1390 RETURN
1400 PRINT AT 23,2;"PRESS ANY KE
Y TO CONTINUE"
1405 IF INKEY$<>"" THEN GOTO 140
0
1410 IF INKEY$="" THEN GOTO 1410
1415 PRINT AT 23,0;B$
1420 RETURN
1500 PRINT AT 3,1;
1505 LET START=1
1510 FOR L=1 TO LINES
1520 LET L$=D$( TO CODE D$)
1540 FOR K=2 TO LEN L$
1550 PRINT L$(K);
1560 NEXT K
1570 PRINT TAB 2;TAB 1;
1575 LET D$=D$(CODE D$+1 TO )
1580 NEXT L
1590 RETURN
1595 PRINT AT 2,0;B$
1600 FOR D=3 TO 23
1605 PRINT AT D,0;B$
1610 NEXT D
1620 RETURN
2020 GOSUB 1120
2050 POKE 16535,D(LEVEL,1)
2060 POKE 16536,D(LEVEL,2)
2070 IF D(LEVEL,1)=0 OR D(LEVEL,
2)=0 THEN STOP
2120 GOSUB 9000
2125 GOSUB 4000
2130 RAND USR 17015
2140 GOSUB 4100
2500 RETURN
2530 LET LIVES=3
2540 LET LEVEL=1
2550 LET SPEED=1
2555 LET SCORE=0
```

continued on page 88



```
2560 GOSUB 2000
2570 LET CHAR=PEEK (1+(PEEK 1653
5+256*PEEK 16536))
2580 IF (CHR$ CHAR="▒" OR CHR$ C
HAR="█") AND PEEK 16572=22 THEN
GOTO 2700
2590 IF CHR$ CHAR>="A" AND CHR$
CHAR<="Z" THEN GOTO 2830
2600 PRINT AT 12,5;"YOU RAN OUT
OF FUEL"
2660 LET LIVES=LIVES-1
2670 PRINT AT 0,19+LIVES;"█"
2680 IF LIVES=0 THEN RETURN
2690 GOTO 2560
2800 PRINT AT 12,5;"YOU CRASHED"
2810 GOTO 2605
2830 FOR L=1 TO 4
2840 PRINT AT 12,5;"WELL DONE, Y
OU MADE IT";AT 12,5;"WELL DONE,
YOU MADE IT"
2850 NEXT L
2860 LET LEVEL=LEVEL+1
2865 IF LEVEL/2=INT (LEVEL/2) TH
EN GOSUB 3300
2870 IF LEVEL<>LEVELS+1 THEN GOT
O 2900
2880 LET LEVEL=1
2890 LET SPEED=SPEED+1
2900 LET MIN=INT (TIME/3000)
3000 LET SEC=INT ((TIME)/50)
3010 LET TTH=INT ((TIME)/5)
3020 LET TTH=TTH-10*SEC
3030 LET SEC=SEC-60*MIN
3040 LET T$=STR$ MIN+" "+STR$ SE
C+" "+STR$ TTH
3050 FOR A=1 TO LEN T$
3060 LET T$(A)=CHR$ (CODE T$(A)+
128)
3070 NEXT A
3080 PRINT AT 15,5;"TIME ";T$;AT
 17,4;"(MIN SEC TENTHS)"
3085 LET GA=G(LEVEL-1)
3087 IF GA=0 THEN LET GA=LEVELS
3090 IF TIME>GA THEN GOTO 2560
3095 PRINT AT 8,4;"TIME BONUS";A
T 8,4;"TIME BONUS"
3100 LET BONUS=(GA-TIME)/25
3105 POKE 16953,5
3110 FOR A=1 TO BONUS
3120 RAND USR 16954
3130 NEXT A
3140 GOTO 2560
3200 RETURN
3305 IF LIVES=3 THEN RETURN
3310 PRINT AT 8,4;"BONUS LIFE"
3320 LET LIVES=LIVES+1
3325 FOR A=1 TO 3
3330 PRINT AT 0,18+LIVES;">";AT
0,18+LIVES;"▶"
3335 NEXT A
3340 RETURN
4015 POKE 16437,255
4020 POKE 16436,255
4040 RETURN
4130 LET HIGH=PEEK 16437
4140 LET LOW=PEEK 16436
4150 LET TI=255*HIGH+LOW
4160 LET TIME=65273-TI
4170 RETURN
4210 LET SCRE=7+PEEK 16396+256*P
EEK 16397
4215 LET S$=""
4220 FOR S=1 TO 4
4230 LET S$=S$+CHR$ PEEK (SCRE+S
)
4235 LET SCORE=SCORE*10
4240 LET SCORE=SCORE+(CODE S$(S)
-156)
4260 NEXT S
4280 PRINT AT 0,0;B$;B$;B$;AT 12
,0;B$;AT 20,1;"█";TAB 1;"█";TAB
1;"█";TAB 0;B$
4285 LET POINT=0
4290 PRINT AT 0,0;B$;B$
4300 FOR A=10 TO 1 STEP -1
4310 IF SCORE>H(A) THEN LET POIN
T=A
4320 NEXT A
4330 IF POINT=0 THEN GOTO 4420
4350 IF POINT=10 THEN GOTO 4400
4360 FOR A=9 TO POINT STEP -1
4370 LET H(A+1)=H(A)
4380 LET H$(A+1)=H$(A)
4385 LET N$(A+1)=N$(A)
4390 NEXT A
4400 LET H$(POINT)=S$
4410 LET H(POINT)=SCORE
4415 LET N$(POINT)="£"
4420 GOSUB 4500
4430 PRINT AT 21,0;"DO YOU WANT
TO PLAY AGAIN (Y/N)?"
4440 IF INKEY$="Y" THEN RETURN
4450 IF INKEY$<>"N" THEN GOTO 44
40
4460 CLS
4470 STOP
4510 PRINT AT 1,4;"HIGH SCORE LE
AGUE";AT 2,4;"████████████████"
4520 FOR A=1 TO 10
4530 PRINT AT A+3,3;
4540 IF N$(A,1)="£" THEN PRINT "
----------"
4550 IF N$(A,1)<>"£" THEN PRINT
N$(A)
4560 PRINT AT A+3,13;"...";TAB 1
7;H$(A);"▧"
4570 NEXT A
4575 PRINT AT 15,2;"YOU SCORED .
..";S$;"▧"
4580 IF POINT=0 THEN RETURN
4590 PRINT AT POINT+3,3;"-"
4607 LET PLACE=1
4608 LET N$(POINT)="█████████"
4610 LET I$=INKEY$
4620 IF I$="" THEN GOTO 4610
4627 IF CODE I$=119 AND PLACE>1
THEN GOTO 4680
4628 IF CODE I$=119 THEN GOTO 46
10
4629 IF CODE I$=118 OR PLACE=10
THEN GOTO 4670
4630 PRINT AT POINT+3,2+PLACE;I$
;
4635 IF PLACE<>9 THEN PRINT "-"
4640 LET N$(POINT,PLACE)=CHR$ (C
ODE I$+128)
4650 IF INKEY$<>"" THEN GOTO 465
0
4655 LET PLACE=PLACE+1
4660 GOTO 4610
4670 RETURN
4680 LET PLACE=PLACE-1
4690 IF PLACE<9 THEN LET N$(POIN
T,PLACE+1)="█"
4695 IF PLACE=1 THEN LET N$(POIN
T,1)="█"
4700 PRINT AT POINT+3,PLACE+2;"-
"
4705 IF PLACE<>9 THEN PRINT "▀"
4710 GOTO 4610
5990 RETURN
6015 POKE 16418,0
6020 LET B$="████████████████████
████████████"
6030 PRINT AT 0,0;B$;B$;B$
6040 PRINT "████████     ▀▀   ▀▀   ▪
█ ██ ████████"
6050 PRINT "████████ ████████ ████████ ████
█ ▄█████████"
6060 PRINT "████████ ██ ██ ██ ███ ██ ███
█ ▪ ████████"
6070 PRINT "████████ ██ ██ ██ ▬▬ ██ ▬▬
█ ▙ ████████"
6080 PRINT "████████▄▄██▄▄██▄▄██▄▄▄▄██▄▄▄█
████▄▄████████"
6090 PRINT B$;B$;B$
6100 PRINT "███     ▀▀▀    ▀█    █
▀▀▀  ▀█ ████"
6110 PRINT "███ ██████ ██████████ ███
███ ████████"
6120 PRINT "███     ▄█    ████ ████
▄█ ███ ██ ██████"
6130 PRINT "███ █████ ███ ███ ███ ▙
▀▀▀ ▬▬ ██ ▀▀▀██"
6140 PRINT "██▄▄███▄▄███▄▄███▄▄███▄▄███▄▄
▄██▄▄▄▄███▄▄████"
6150 PRINT B$;B$;"█████████████ BY
 A.BAXTER 1984████"
6160 PRINT B$;B$;B$;B$
6161 IF SA=1 THEN SAVE "MOON PAT
RO█"
6165 SLOW
6170 LET C$="MOON PATROL.....MOO
N PATROL.....MOON PATROL.....PRE
SS "I" FOR INSTRUCTIONS.....PRES
S "P" TO PLAY.....(C) 1984 A.BAXT
ER....."
6180 PRINT AT 23,0;C$( TO 32)
6190 LET C$=C$(2 TO )+C$(1)
6200 LET I$=INKEY$
6250 IF I$<>"I" AND I$<>"P" THEN
 GOTO 6180
6260 LET IN=0
6270 IF I$="I" THEN LET IN=1
6280 GOTO 130
6990 STOP
8000 REM MACHINE CODE
8010 REM DATA
8020 LET A$="4082 2A0C40 010B00
09 34 3EA6 BE C0 369C 2B 3E8E BE
 20F3 C9"
8030 LET A$=A$+"4097 7B 41 2A0C4
0 11F802 19 EB 2A9740 23 7D 3297
40 7C 329840 E5 0620 EDA0 10FC E
1 23 0600 4E C9"
8040 LET A$=A$+"40BA F340 16 14
2ABA40 E5 C9 3EEF DBFE CB47 2009
 3ABD40 21BC40 BE 2008 21E140 22
BA40 1805 21BC40 35 C9 21BC40 34
 3E16 21BC40 BE C0 21F340 22BA40
 C9 3EEF DBFE CB47 C0 21C340 22B
A40 18DA"
8050 LET A$=A$+"4102 10 0A 08 2A
0C40 23 3A02 4147 3E00 B8 2806 1
12100 19 10FC 1600 3A0341 5F 19
3A0441 77 C9"
8060 LET A$=A$+"412A 15 00 212A4
1 3A2B41 FE00 2813 7E 320341 3E0
1 320241 3E80 320441 35 CD0541 C
9 34 7E 320341 3E01 320241 3E88
320441 CD0541 C9"
8070 LET A$=A$+"415C 01 10 215C4
1 34 3A5D41 BE C0 3E01 322B41 36
00 CD2C41 C9"
8080 LET A$=A$+"4178 2000 0100 3
000 0500 ED5B7B41 1B 1C 1D 20FB
14 15 20F7 3EFD DBFE CB4F 201D 3
A7B41 218141 BE 2006 23 3A7C41 B
E C8 2A7B41 ED5B7D41 A7 ED52 227
B41 C9 CB47 C0 3A7B41"
8090 LET A$=A$+"217F41 BE 2006 2
3 3A7C41 BE C8 2A7B41 ED5B7D41 1
9 227B41 C9"
8100 LET A$=A$+"4109 00 2A9740
23 7E FE26 3808 FE40 3004 3E04 1
832 3ABC40 FE16 2804 3E01 18 27
2A9740 23 7E"
8105 GOTO 8300
8110 LET A$="FE89 2004 3E00 181A
 FEA6 2004 3E02 1812 FE97 2004 3
E03 180A FE03 2004 3E05 1802 3E0
4 32D941 C9"
8120 LET A$=A$+"4227 01 212742 4
6 3E00 322B41 C5 CD2C41 C1 10F9
C9"
8130 LET A$=A$+"4239 10 213942
46 C5 CD8240 C1 10F9 C9"
8140 LET A$=A$+"424C 3ABC40 3202
41 3E01 320341 3E80 320441 CD054
1 CDBE40 3ABC40 320241 3E92 3204
41 CD0541 C9"
8150 LET A$=A$+"4277 CD4C42 CD99
40 CD5E41 3A2A41 FE08 C8 CD8240
CDDA41 3AD941 FE00 282F FE04 C8
FE01 F5 2009 0601 C5 CD5E41"
8160 LET A$=A$+"C1 10F9 F1 FE05
2008 0602 F5 C5 CD5E41 C1 10F9 F
1 FE02 F5 CC2842 F1 FE03 F5 CC3A
42 F1 CD8341 18B0"
8300 FAST
8310 IF A$(1)=" " THEN GOTO 8380
8320 IF A$(1)="█" THEN GOTO 841
5
8330 LET LOC=LOC+1
8340 IF PEEK LOC=118 THEN STOP
8350 LET NUM=(CODE A$*16+CODE (A
$(2)))-476
8360 POKE LOC,NUM
8370 LET A$=A$(2 TO )
8380 LET A$=A$(2 TO )
8390 IF LEN A$>0 THEN GOTO 8310
8400 SLOW
8410 RETURN
8415 LET LOC=0
8420 FOR A=1 TO 4
8430 LET LOC=LOC*16
8440 LET LOC=LOC+(CODE A$-156)
8450 LET A$=A$(2 TO )
8460 NEXT A
8465 LET LOC=LOC-1
8470 GOTO 8310
9040 POKE 16682,21
9050 POKE 16572,22
9051 POKE 16570,243
9053 POKE 16571,64
9057 LET DEL=INT (6000/(SPEED+.5
))
9058 LET DELAY=100+(200*INT (DEL
/200))
9060 LET MAXDEL=DELAY+1000
9070 POKE 16763,DELAY-256*INT (D
ELAY/256)
9080 POKE 16764,INT (DELAY/256)
9090 LET INCREMENT=200
9100 POKE 16765,INCREMENT-256*IN
T (INCREMENT/256)
9110 POKE 16766,INT (INCREMENT/2
56)
9130 POKE 16767,MAXDEL-256*INT (
MAXDEL/256)
9140 POKE 16768,INT (MAXDEL/256)
9150 LET MINDEL=100
9160 POKE 16769,MINDEL-256*INT (
MINDEL/256)
9170 POKE 16770,INT (MINDEL/256)
9180 POKE 16733,17
9190 POKE 16732,13
9200 POKE 16935,2
9210 POKE 16953,20
9220 RETURN
9240 DIM G(LEVELS)
9250 LET G(1)=1200
9260 LET G(2)=1650
9270 LET G(3)=1900
9280 LET G(4)=2600
9490 RETURN
9730 LET STAGE=1
9740 LET POS=1
9750 LET X=22
9760 LET DROP=0
9770 LET Y=1
9780 LET TOP=20
9790 LET BOUNCE=0
9800 LET LEVEL=1
9810 LET SPEED=1
9820 LET LEVELS=4
9830 GOSUB 9230
9840 DIM H$(10,4)
9845 DIM N$(10,9)
9850 DIM H(10)
9855 FOR A=1 TO 9
9856 LET PO=11-A
9857 LET H$(PO)="▧"+CHR$ (A+156)
+"▧▧"
9859 LET H(PO)=A+100
9861 LET N$(PO)="BEAT THAT"
9863 NEXT A
9865 LET N$(1)="BEAT THAT"
9867 LET H$(1)="1500"
9868 LET H(1)=1500
9900 RETURN
9920 DIM D(LEVELS,2)
9925 LET D(1,1)=205
9930 LET D(1,2)=66
9935 LET D(2,1)=88
9940 LET D(2,2)=67
9945 LET D(3,1)=14
9950 LET D(3,2)=68
9955 LET D(4,1)=183
9960 LET D(4,2)=68
9980 RETURN
```

GOLF CLUB



JOIN the Spectrum **Golf Club** and improve your handicap in a splendid simulation of the game by Guy Morgan of Llantrisant in Mid Glamorgan.

Hazards include rough, trees, streams and bunkers. You are allowed a full set of clubs and can input strength and direction for each stroke. Full instructions are provided within the game, which runs on the 48K Spectrum.

Golf Club uses our special abbreviations for graphics characters, so please read the instructions on the first page of Program Printout before entering the program.

You can easily design your own holes. For each hole the relevant DATA statements are lines 8000+hole number*10 and 8200+hole number*10.

To design a new hole first map it out on a grid based on the size of the screen. Decide on the number of yards and the par. Then use the following table to compile the DATA in the order shown. If you do not require an item use 9999.

The second DATA statement should contain the length of the hole in yards, the par, and a scale factor. Calculate the scale factor using a base of 500 yards which has a factor of one.

1 TEE	0401	CO-ORDS
2 GREEN	0326	CO-ORDS OF TOP LEFT CORNER
3 HOLE	0427	CO-ORDS
4 TREES 1	0110	START AND FINISH LINES
5 TREES 1	1219	START AND FINISH COLS
6 TREES 1	0100	TREE TYPE (0100 or 0200)
7 TREES 2	1820	START AND FINISH LINES
8 TREES 2	0031	START AND FINISH COLS
9 TREES 2	0100	TREE TYPE (0100 or 0200)
10 BUNKER 1	1313	CO-ORDS
11 BUNKER 2	1216	CO-ORDS
12 BUNKER 3	0720	CO-ORDS
13 LAKE	9999	CO-ORDS OF TOP LEFT CORNER
14 STREAM	9999	CO-ORDS OF START
15 STREAM	9999	CO-ORDS OF FINISH
16 TOP ROUGH	0200	END LINE, STEP
17 BOT ROUGH	1606	START LINE, STEP

The above values are those for the first hole of the course in the program.

```
   1 REM initialise
   5 POKE 23609,100: RANDOMIZE :
 PAPER 7: INK 0: BRIGHT 0: OVER
0: FLASH 0: BORDER 7: CLS
   7 PRINT AT 2,8; PAPER 1; INK
7;"WE WELCOME YOU";AT 5,12;"TO T
HE";AT 9,6;"SPECTRUM GOLF CLUB";
AT 11,1;"(Professional, Clive Si
nclair)"
  10 DEF FN x(h)=(INT (h/100)):
DEF FN y(h,x)=(h-100*x)
  15 DIM h(18): LET w$="<↑>R"
  19 REM load holes
  20 DIM h$(18,20,4): RESTORE
  25 FOR m=1 TO 18
  30 FOR n=1 TO 17: READ q: LET
h$(m,n)=STR$ q: NEXT n
  35 NEXT m
  40 LET finish=4000: LET stream
=1600: LET print=1500: LET tee=1
000: LET bunker=1050: LET green=
1100: LET hole=1150
  45 LET bot r=1300: LET top r=1
200: LET trees=1400: LET lake=15
50
  50 DIM s(18): DIM l(18): DIM p
(18)
  55 FOR n=1 TO 18
  60 READ l(n): READ p(n): READ
s(n)
  65 NEXT n
  70 REM LOAD UDG
  75 FOR n=USR "a" TO 65535: REA
D u: POKE n,u: NEXT n
  79 REM start
  80 LET hl=0
  90 PRINT AT 14,1;"If you need
further advice on"'" playing the
 course then please"'" press 1 o
therwise please"'" press enter."
  95 INPUT " 1 for Instructions
";q$
 100 IF q$="1" THEN  CLS : GO SU
B 2000
 105 CLS : PRINT AT 2,1;"Please
inform the professional"'" of yo
ur name and handicap."'" (0 - 24
)"
 110 INPUT "NAME ";n$
 115 INPUT "HANDICAP "; LINE q$
 120 IF q$<"0" OR q$>"9" THEN  G
O TO 115
 125 IF VAL q$<0 OR VAL q$>24 TH
EN  GO TO 115
 130 LET hc=VAL q$
 135 PRINT AT 6,1;"Please press
any key when you "'" are ready f
or the first hole."
 145 PAUSE 0
 149 REM main loop
 150 PAPER 4: INK 0: BRIGHT 0: O
VER 0: FLASH 0: BORDER 7: CLS
 155 LET hl=hl+1
 160 IF hl=19 THEN  GO TO finish
 165 LET t1=0: LET ob1=0: LET sc
=0: LET cg=163: LET cga=32: LET
s1=0: LET r1=0: LET t1=0: LET w1
=0: LET g1=0
 169 REM print display
 170 GO SUB top r
 180 GO SUB bot r
 190 LET t1=6: LET t2=4: LET t3=
5: GO SUB trees
 200 LET t1=9: LET t2=7: LET t3=
8: GO SUB trees
```

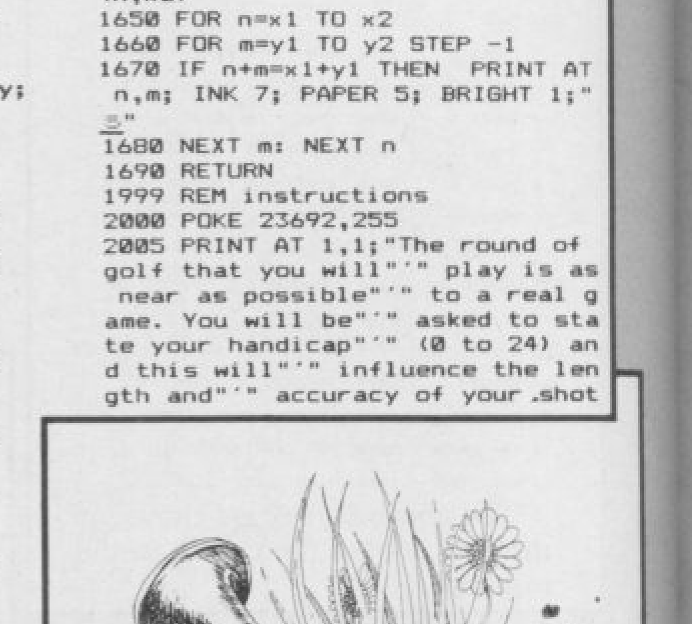
continued on page 90

continued from page 89

```
 210 FOR n=10 TO 12: LET b1=n: G
O SUB bunker: NEXT n
 215 GO SUB lake
 220 GO SUB stream
 225 GO SUB green
 230 GO SUB hole
 235 GO SUB tee
 240 GO SUB print
 245 GO SUB 7050
 299 REM hit ball
 300 IF w1 THEN  LET w1=0: GO TO
 3150
 305 INPUT "CLUB ? "; LINE l$
 307 IF l$="" THEN  GO TO 305
 310 IF l$(1)="(sp)" THEN  GO TO
 305
 315 IF l$(1)="p" THEN  GO TO 33
00
 320 IF l$(1)="w" THEN  LET c=10
: GO TO 360
 325 IF LEN l$>1 THEN  IF l$(1 T
O 2)="sw" AND s1<>1 THEN  LET c=
12: GO TO 360
 330 IF LEN l$>1 THEN  IF l$(1 T
O 2)="sw" AND s1=1 THEN  LET l2=
INT (RND*41): LET s1=0: GO TO 37
5
 340 LET cw=0: IF LEN l$>1 THEN
 IF l$(2)="w" THEN  LET l$=l$(1)
: LET cw=20
 345 IF LEN l$>1 THEN  GO TO 305
 350 LET c=VAL l$(1)
 360 LET l1=(220-c^2)-c*2+cw
 370 LET l2=l1-(hc/c)
 375 INPUT "% SWING ? (30 TO 100
)"; LINE s$
 380 IF s$="" THEN  GO TO 375
 385 IF s$="100" THEN  GO TO 390
 387 IF s$(1)<"3" OR s$(1)>"9" T
HEN  GO TO 375
 388 IF VAL s$>100 THEN  GO TO 3
75
 390 LET sw=VAL s$
 395 LET l=(l2/20)*(sw/100)*s(hl
)
 400 INPUT "direction. clock ";d
$
 405 IF d$="" THEN  GO TO 400
 410 IF d$<"1" OR d$>"9" THEN  G
O TO 400
 415 IF VAL d$>12 THEN  GO TO 40
0
 420 IF r1 THEN  LET r1=0: GO SU
B 3050
 425 IF s1 AND l$<>"sw" THEN  GO
 TO 3000
 430 GO SUB 3350
 440 LET da=(VAL d$)*PI/6+da1
 455 IF t1 THEN  LET t1=0: GO SU
B 3020
 460 LET yd=(l*SIN da)+by+wy*l/5
: LET xd=bx-(l*COS da)+wx*l/5
 465 IF xd<1 THEN  LET xd=1: LET
 ob1=1
 470 IF xd>20 THEN  LET xd=20: L
ET ob1=1
 475 IF yd<0 THEN  LET yd=0: LET
 ob1=1
 480 IF yd>31 THEN  LET yd=31: L
ET ob1=1
 499 REM move ball
 500 POKE 23693,cga
 510 PRINT AT bx,by;CHR$ cg
 515 IF ob1 THEN  GO SUB 7000
 520 LET x=xd: LET y=yd: GO SUB
9000
 525 LET cg=i: LET cga=ATTR (xd,
yd)
 530 PRINT AT xd,yd; BRIGHT 8; I
NK 7; PAPER 8;"H"
 535 LET bx=xd: LET by=yd
 540 IF CHR$ cg="A" OR CHR$ cg="
C" OR CHR$ cg="D" OR CHR$ cg="E"
 OR CHR$ cg="F" OR CHR$ cg="G" O
R CHR$ cg="O" OR CHR$ cg="U" THE
N  LET g1=1
 545 IF g1 THEN  PRINT AT xd,yd;
 OVER 1; PAPER 5; INK 7;"(sp)"
 550 IF CHR$ cg="B" THEN  LET s1
=1
 555 IF CHR$ cg="P" THEN  LET r1
=1
 560 IF CHR$ cg="M" OR CHR$ cg="
N" THEN  LET t1=1
 565 IF CHR$ cg="S" OR CHR$ cg="
I" OR CHR$ cg="J" OR CHR$ cg="K"
 OR CHR$ cg="L" THEN  LET w1=1
```



```
 580 IF s1 THEN  PRINT AT xd,yd;
 OVER 1; INK 7; PAPER 6;"(sp)"
 585 LET sc=sc+1
 595 PRINT AT 21,23; INK 0; PAPE
R 5;"score ";sc
 600 IF CHR$ cg="Q" THEN  GO TO
3250
 610 GO TO 300
 998 STOP
 999  REM tee
1000 LET h=VAL h$(hl,1)
1010 LET x=FN x(h): LET y=FN y(h
,x)
1020 PRINT AT x,y; INK 0;"T"
1030 LET bx=x: LET by=y
1040 RETURN
1049 REM bunker
1050 IF h$(hl,b1)="9999" THEN  R
ETURN
1060 LET h=VAL h$(hl,b1)
1070 LET x=FN x(h): LET y=FN y(h
,x)
1080 PRINT AT x,y; INK 6; PAPER
4;"B"
1085 RETURN
1099 REM green
1100 LET h=VAL h$(hl,2)
1110 LET x=FN x(h): LET y=FN y(h
,x)
1120 PRINT AT x,y; INK 5; PAPER
4;"CAD";AT x+1,y;"UBG";AT x+2,y;
"EOF"
1130 RETURN
1149 REM hole
1150 LET h=VAL h$(hl,3)
1160 LET x=FN x(h): LET y=FN y(h
,x)
1170 PRINT AT x+1,y; PAPER 5; IN
K 0;"Q"
1180 RETURN
1199 REM top rough
1200 IF h$(hl,16)="9999" THEN  R
ETURN
1210 LET h=VAL h$(hl,16)
1220 LET x=FN x(h): LET y=FN y(h
,x)
1230 LET c1=31
1240 FOR r=0 TO x
1250 FOR c=0 TO c1
1260 IF RND>.2 THEN  PRINT AT r,
c; INK 1; BRIGHT 0;"P"
1270 NEXT c
1280 LET c1=c1-y
1285 NEXT r
1290 RETURN
1299 REM bot rough
1300 IF h$(hl,17)="9999" THEN  R
ETURN
1310 LET h=VAL h$(hl,17)
1320 LET x=FN x(h): LET y=FN y(h
,x)
1330 LET c1=y
1340 FOR r=x TO 21
1350 FOR c=0 TO c1
1360 IF RND>.2 THEN  PRINT AT r,
c; INK 1; BRIGHT 0;"P"
1370 NEXT c
1380 LET c1=c1+y: IF c1>=31 THEN
 LET c1=31
1385 NEXT r
1390 RETURN
1399 REM trees
1400 IF h$(hl,t1)="9999" THEN  R
ETURN
1410 LET p$="M"
1415 IF VAL h$(hl,t1)=100 THEN
LET p$="N"
1420 LET h=VAL h$(hl,t2)
1430 LET n1=FN x(h): LET n2=FN y
(h,n1)
1440 LET h=VAL h$(hl,t3)
1450 LET m1=FN x(h): LET m2=FN y
(h,m1)
1460 FOR n=n1 TO n2: FOR m=m1 TO
 m2
1470 IF RND>.6 THEN  PRINT AT n,
m; INK 2;p$
1480 NEXT m: NEXT n
1485 RETURN
1499 REM wind
1500 LET wn=INT (RND*4)+1
1510 IF wn=1 THEN  LET wy=-1: LE
T wx=0
1515 IF wn=2 THEN  LET wy=0: LET
 wx=-1
1520 IF wn=3 THEN  LET wy=1: LET
 wx=0
1525 IF wn=4 THEN  LET wy=0: LET
 wx=1
1529 REM print
1530 PRINT AT 0,0; PAPER 5;" HOL
E ";hl;TAB 9;l(hl);" Yds";TAB 17
;"PAR ";p(hl);TAB 26;"WIND ";w$(
wn)
1540 RETURN
1549 REM lake
1550 IF h$(hl,13)="9999" THEN  R
ETURN
1560 LET h=VAL h$(hl,13)
1570 LET x=FN x(h): LET y=FN y(h
,x)
1580 PRINT AT x,y; INK 7; PAPER
5; BRIGHT 1;"ISJ";AT x+1,y;"SSS"
;AT x+2,y;"SSS";AT x+3,y;"KSL"
1590 RETURN
1599 REM stream
1600 IF h$(hl,14)="9999" THEN  R
ETURN
1610 LET h=VAL h$(hl,14)
1620 LET x1=FN x(h): LET y1=FN y
(h,x1)
1630 LET h=VAL h$(hl,15)
1640 LET x2=FN x(h): LET y2=FN y
(h,x2)
1650 FOR n=x1 TO x2
1660 FOR m=y1 TO y2 STEP -1
1670 IF n+m=x1+y1 THEN  PRINT AT
 n,m; INK 7; PAPER 5; BRIGHT 1;"
S"
1680 NEXT m: NEXT n
1690 RETURN
1999 REM instructions
2000 POKE 23692,255
2005 PRINT AT 1,1;"The round of
golf that you will"'" play is as
 near as possible"'" to a real g
ame. You will be"'" asked to sta
te your handicap"'" (0 to 24) an
d this will"'" influence the len
gth and"'" accuracy of your shot
```



```
s."''
2010 PRINT " You will carry a no
rmal bag of"'" clubs consisting
of :-"
2020 PRINT AT 12,7;"Driver .....
....1w";AT 13,7;"        ........
.2w";AT 14,7;"Spoon ..........3w
";AT 15,7;"1 - 9 irons ....1 - 9
";AT 16,7;"wedge ..........w";AT
 17,7;"sand wedge .....sw";AT 18
,7;"putter .........p"
2030 PRINT AT 21,1;"(Any key to
continue)": PAUSE 0
2040 PRINT '" If you attempt to
hit the ball"'" off the screen y
ou will incur"'" 2 penalty strok
es for going out"'" of bounds an
d your ball will"'" be replaced
on the edge of"'" the screen. "
2050 PRINT '" If you drive into
water you"'" will incur 2 penalt
y strokes"'" and your ball will
be replaced"'" on the tee side o
f the water."
2060 PRINT ''" For each hole you
 will be told"'" the yardage, pa
r, direction of"'" wind and numb
er of strokes so"'" far. This in
formation is"'" displayed above
and below the"'" plan of the hol
e."
2070 PRINT 'TAB 1;"(Any key to c
ontinue)": PAUSE 0
2080 PRINT '''" The direction of
 your stroke"'" is entered in te
rms of a clock"'" face. The stre
ngth can be from"'" 30% to 100%
of a full swing."'" Information
about the result"'" of the previ
ous stroke is shown"'" below the
 plan of the hole."
2085 PRINT '" At the end of your
 round you"'" will be shown your
 card for"'" that round."
2090 PRINT ''''''''AT 21,1;"(Any
 key to continue)": PAUSE 0: RET
URN
2999 REM sand
3000 PRINT AT 21,0; PAPER 6;"Tak
e a sand wedge"
3010 PAUSE 100: GO SUB 7050: GO
TO 585
3019 REM trees
3020 LET da=da+(1-INT (RND*3))/1
0
3049 REM rough
3050 LET l=l-INT (RND*4)
3060 RETURN
3149 REM water
3150 LET yd=by-3: LET xd=bx
3160 LET w1=0
3170 PRINT AT 21,0; PAPER 6;"In
water "
3180 LET sc=sc+1
3190 PAUSE 100: GO SUB 7050: GO
TO 500
3249 REM hole
3250 PRINT AT 21,0; INK 0; PAPER
 5; FLASH 1;"You have holed out
in ";sc;" strokes";"(sp)" AND sc
<10
3260 PAUSE 200
3265 LET h(hl)=sc
3270 GO TO 150
3299 REM putt
3300 INPUT "STRENGTH OF PUTT (1
- 3) "; LINE v$
3310 IF v$<"1" OR v$>"3" THEN  G
O TO 3300
3320 LET wy=0: LET wx=0
3325 LET l=VAL v$
3330 GO TO 400
3349 REM random angle
3350 LET da2=(PI/18)*hc/12
3360 LET da1=da2*(INT (RND*3)-1)
3370 RETURN
3999 REM finish
4000 PAPER 7: INK 0: CLS
4005 LET pt1=0: LET pt2=0: LET h
t1=0: LET ht2=0: LET lt1=0: LET
lt2=0
4010 PRINT AT 1,7;"SPECTRUM GOLF
 CLUB";AT 3,5;"LENGTH 6505 YDS
PAR 72"
4015 PRINT AT 5,0;"    YDS PAR
SC     YDS PAR  SC"
4020 PLOT 3,44: DRAW 0,93: DRAW
249,0: DRAW 0,-93: DRAW -249,0
4025 PLOT 126,44: DRAW 0,93
4030 PLOT 22,44: DRAW 0,93: PLOT
 60,44: DRAW 0,93: PLOT 93,44: D
RAW 0,93
4035 PLOT 148,44: DRAW 0,93: PLO
T 187,44: DRAW 0,93: PLOT 220,44
: DRAW 0,93
4040 FOR n=1 TO 9: PRINT AT n+6,
1;n;AT n+6,16;n+9: NEXT n
4043 PRINT AT 20,1;n$
4045 FOR n=1 TO 9: LET ht1=ht1+h
(n): LET ht2=ht2+h(n+9): LET lt1
=lt1+l(n): LET lt2=lt2+l(n+9): L
ET pt1=pt1+p(n): LET pt2=pt2+p(n
+9): PRINT AT n+6,4;l(n);AT n+6,
9;p(n);AT n+6,13;h(n);AT n+6,20;
l(n+9);AT n+6,25;p(n+9);AT n+6,2
9;h(n+9): NEXT n
4050 PRINT AT 17,0;"(3*sp)";lt1;
"(sp)";pt1;"(3*sp)";ht1;AT 17,16
;"(3*sp)";lt2;"(2*sp)";pt2;"(3*s
p)";ht2
4055 PRINT AT 19,18;"TOTAL ";ht1
+ht2;AT 20,15;"HANDICAP ";hc;AT
21,19;"NETT ";ht1+ht2-hc
4060 PRINT AT 20,1;n$
6090 STOP
6999 REM out of bounds
7000 PRINT AT 21,0; INK 0; PAPER
 5;"Out of Bounds. "
7010 LET ob1=0
7020 LET sc=sc+2
7030 PAUSE 100: GO SUB 7050: RET
URN
7049 REM clear bottom line
7050 PRINT AT 21,0; PAPER 5;"(32
*sp)"
7060 RETURN
7999 REM data
8010 DATA 0401,0326,0427,0110,12
19,0100,1820,0031,0100,1313,1216
,0728,9999,9999,9999,0200,1606
8020 DATA 1201,0928,0929,0108,10
15,0100,1420,1631,0200,1210,1126
,0825,9999,9999,9999,1002,1403
8030 DATA 1101,0822,0823,0417,27
31,0200,9999,9999,9999,0720,0918
,1220,9999,9999,9999,0802,1405
8040 DATA 1801,0426,0527,1321,11
31,0100,9999,9999,9999,0330,0524
,0530,9999,9999,9999,1402,9999
8050 DATA 0401,1626,1628,0106,09
31,0200,0711,1831,0200,1427,1630
,1830,9999,9999,9999,0300,0702
8060 DATA 0801,1628,1729,0108,20
31,0200,1221,0011,0200,1214,1825
,1329,9999,0123,2103,0505,1203
8070 DATA 0201,1426,1428,0112,10
31,0100,9999,9999,9999,1411,1508
,1730,9999,9999,9999,9999,1610
8080 DATA 1501,0626,0727,0610,03
11,0200,1421,2131,0100,0425,0530
,1027,1210,9999,9999,1302,1711
8090 DATA 1701,1625,1626,0107,25
31,0100,0820,0821,0100,1429,1924
,1930,9999,9999,9999,1005,9999
8100 DATA 1001,0927,1028,1421,19
31,0200,9999,9999,9999,1024,1325
,1116,9999,9999,9999,0700,1304
```



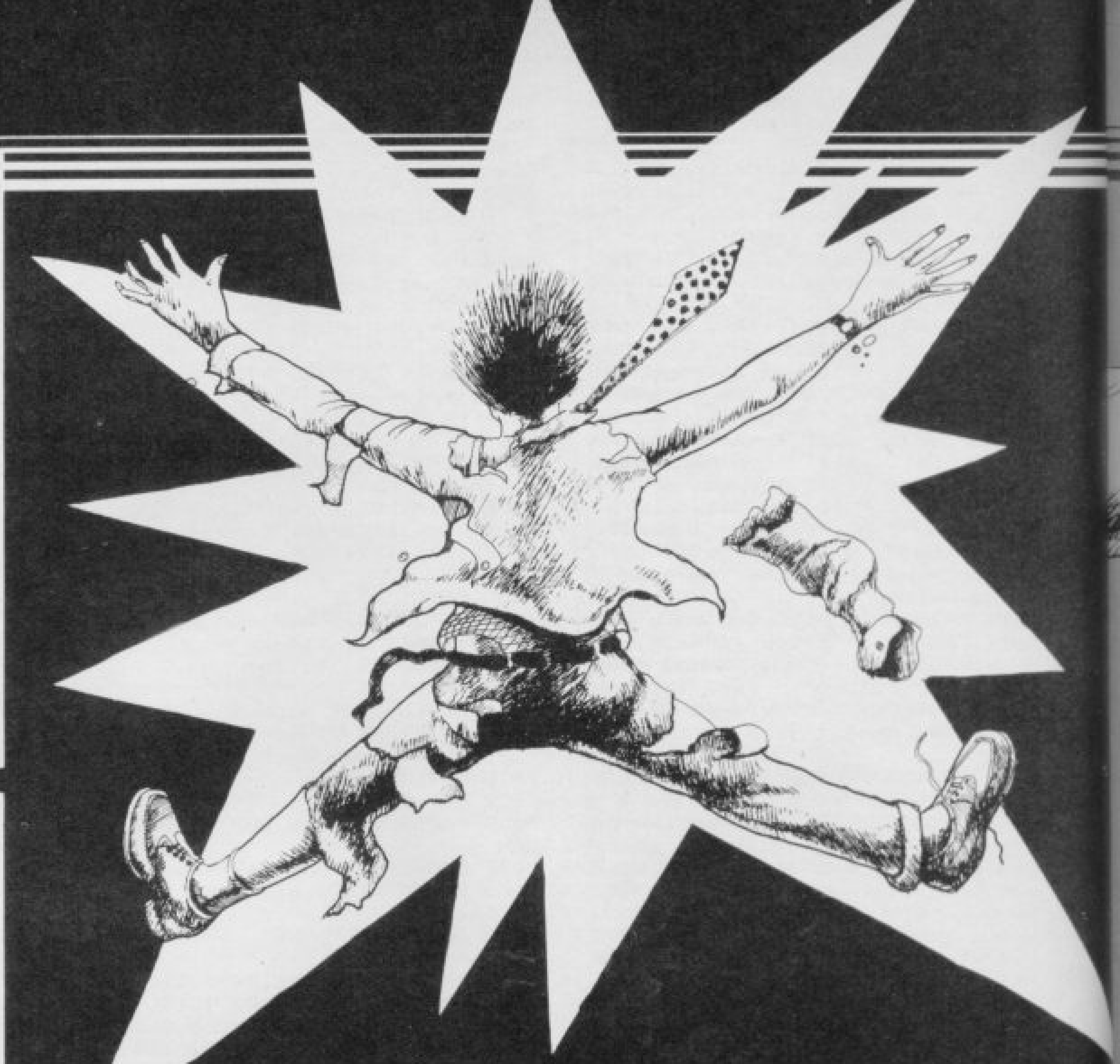


```
8110 DATA 1802,0424,0426,0110,00
14,0100,1221,1731,0100,0225,0429
,0827,9999,9999,9999,9999,9999
8120 DATA 1302,0626,0727,0207,11
17,0200,1321,2231,0200,1214,1415
,0824,9999,9999,9999,1002,1631
8130 DATA 0302,1525,1626,9999,99
99,9999,9999,9999,9999,0713,0911
,1829,0922,0130,2011,0200,1931
8140 DATA 1701,1427,1328,1120,10
23,0200,0107,2131,0200,0716,0918
,1525,9999,9999,9999,1003,1831
8150 DATA 1001,1123,1125,0120,28
31,0100,0120,2831,0200,0925,1116
,1525,9999,9999,9999,0801,1207
8160 DATA 1002,0926,1027,9999,99
99,9999,9999,9999,9999,0728,0930
,1229,9999,0130,2011,0701,1311
8170 DATA 1101,0526,0527,0108,00
21,0100,1420,0026,0200,1017,1217
,0930,9999,9999,9999,0200,9999
8180 DATA 0202,1727,1828,0107,09
31,0200,0813,2031,0100,1527,1825
,1217,9999,9999,9999,9999,0702
8210 DATA 300,4,1.7
8220 DATA 500,5,1
8230 DATA 250,3,2.2
8240 DATA 400,4,1.5
8250 DATA 200,3,2.5
8260 DATA 350,4,1.4
8270 DATA 420,4,1.45
8280 DATA 480,5,1.15
8290 DATA 280,4,1.75
8300 DATA 330,4,1.6
8310 DATA 160,3,3.2
8320 DATA 450,4,1.3
8330 DATA 495,5,1
8340 DATA 400,4,1.5
8350 DATA 440,4,1.35
8360 DATA 190,3,2.8
8370 DATA 470,5,1.2
8380 DATA 390,4,1.6
8390 DATA 247,255,255,255,255,25
5,255,255,96,248,254,254,255,127
,127,30,3,15,31,63,127,127,255,2
55,192,240,252,254,254,255,255,2
55,255,255,255,127,63,31,31,7,25
5,254,254,254,252,248,224,192,25
5,255,255,254,255,255,255,255,0,
0,24,60,60,24,0,0,3,14,24,17,50,
36,109,192,192,32,24,198,34,35,1
45,73,146,137,72,36,35,16,24,7,7
3,137,17,34,66,4,28,240,8,8,28,2
8,62,62,8,8,28,62,127,127,127,62
,8,8,255,255,255,255,255,255,255
,247,0,82,34,0,0,74,68,0,0,0,24,
36,36,24,0,0,8,8,8,8,8,62,28,8,0
,48,73,134,0,48,73,134,126,1,57,
17,17,17,1,126,255,255,255,255,1
27,255,255,255
9000 LET i=CODE SCREEN$ (x,y): I
F i THEN  RETURN
9010 POKE 23606,PEEK 23675: POKE
 23607,PEEK 23676-1
9020 LET i=CODE SCREEN$ (x,y)+11
2
9030 POKE 23606,0: POKE 23607,60
: RETURN
```

BOMBER BORIS has a problem. All the bombs are ticking away and he must run around the minefield defusing them as quickly as he can. Watch out, though — Boris can only defuse the bomb which is actually at countdown stage, so he must be very careful which routes he takes through the minefield or he may find himself cut off.

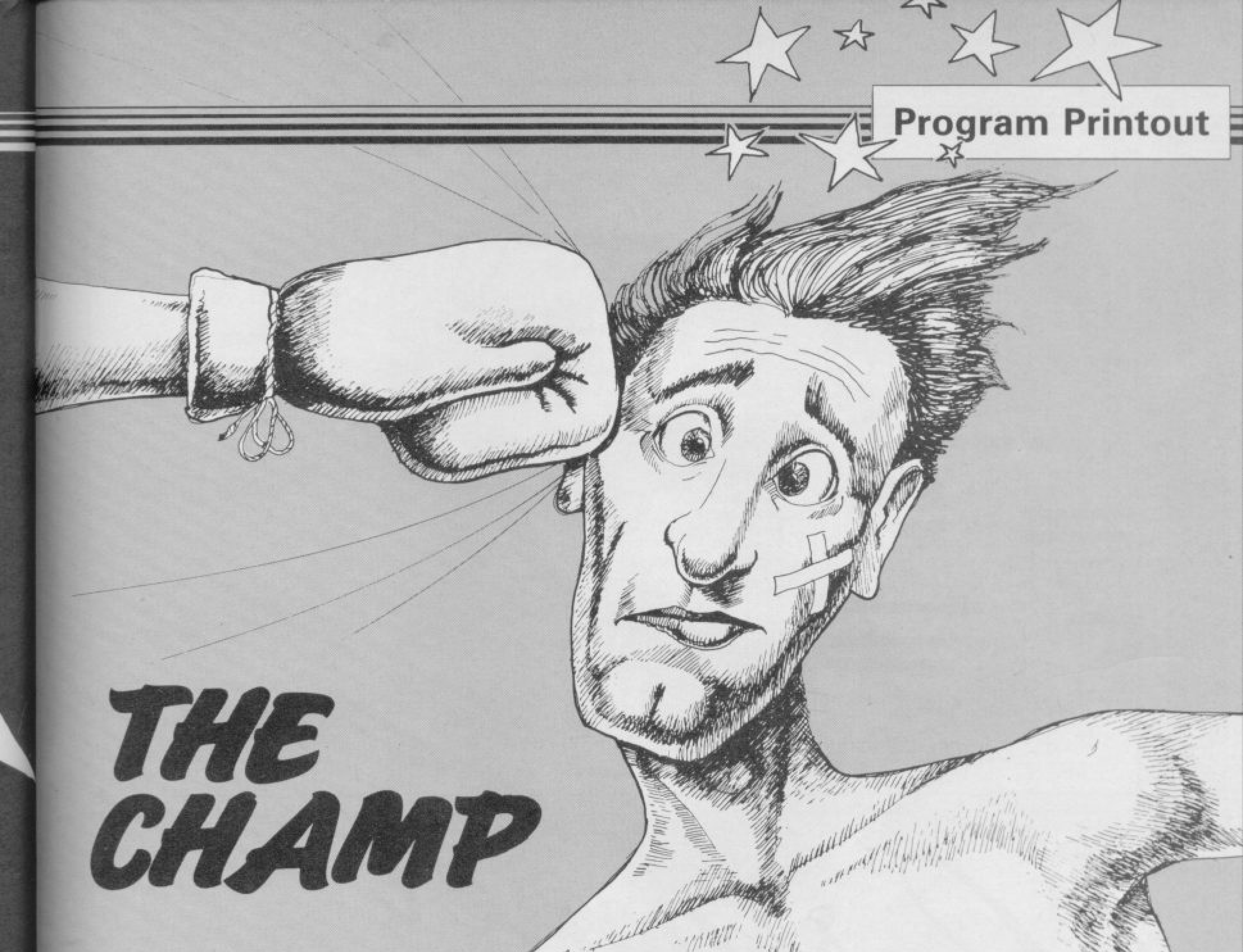
The program was written by K P Holloway of Andover in Hampshire, and runs on any Spectrum.

Bomber Boris uses our special abbreviations for graphics characters, so please read the instructions on the first page of Program Printout before entering the listing.



BOMBER BORIS

```
   6 BORDER 0
   7 PRINT AT 11,10; INK 6; FLAS
H 1; PAPER 0;" STOP TAPE "
   8 GO SUB 800
   9 GO SUB 900
  10 LET u$="ABCDEFGHIJ": LET t$
="PKLMNO"
  15 LET sc=0: LET l=2
  20 LET d=11: LET a=16: LET d1=
d: LET a1=a
  25 LET hi=0
  30 DIM r(8): DIM c(8)
 100 BORDER 0: PAPER 1: INK 3: C
LS
 110 FOR i=2 TO 20: PRINT  INK 5
;AT i,1;"(30*S)";: NEXT i
 120 LET c=60
 130 PRINT  PAPER 0;AT 0,0; INK
3;"(32*sp)";AT 0,0;"(sp)R(sp)Q(s
p)R"; INK 6;"(4*sp)score:0(4*sp)
(sp) high:";hi
 180 FOR i=1 TO 8: LET r(i)=INT
(RND*19)+2: LET c(i)=INT (RND*30
)+1
 190 PRINT  INK 6;AT r(i),c(i);"
T": NEXT i
 195 LET b=1
 196 PRINT AT 0,0; PAPER 0;("(2*
sp)" AND l=2);("(4*sp)" AND l=1)
;("(6*sp)" AND l=0)
 200 PRINT AT d,a; INK 3;"Q"
 210 LET d1=d+(INKEY$="6")-(INKE
Y$="7")
 215 LET a1=a+(INKEY$="8")-(INKE
Y$="5")
 220 LET at=ATTR (d1,a1)
 225 IF at=79 THEN  LET b=b+1: L
ET sc=sc+c: LET c=60: IF b=9 THE
N  GO TO 700
 230 IF at=14 THEN  GO TO 400
 232 IF at=13 THEN  LET sc=sc+1
 235 IF at=11 THEN  LET a1=a: LE
T d1=d
 237 BEEP .01,5
 240 PRINT AT d,a; INK 3;"(sp)";
AT d1,a1;"R"
 250 LET a=a1: LET d=d1
 270 GO SUB 600
 275 IF c=0 THEN  GO TO 350
 280 PRINT AT 0,16; INK 6; PAPER
 0;sc
 290 BEEP .01,-10
 300 GO TO 200
 350 REM out of time
 360 FOR i=b TO 8: PRINT AT r(i)
,c(i); FLASH 1; PAPER 8; INK 2;"
T": NEXT i
 370 LET l=0
 400 REM bang
 410 PRINT AT d,a; INK 3;"(sp)";
AT d1,a1; INK 2; FLASH 1;"Q"
 420 BEEP 2,-25
 430 PRINT AT d1,a1; INK 3;"(sp)
";AT 0,0;
 450 RESTORE 460: FOR i=1 TO 14:
 READ z,x: BEEP z,x: NEXT i
 460 DATA .6,0,.4,0,.2,0,.6,0,.4
,0,.2,0,.6,0,.4,3,.2,2,.4,2,.2,0
,.4,0,.2,-1,.6,0
 470 PRINT  PAPER 0;AT 0,0;("(4*
sp)" AND l=2);("(6*sp)" AND l=1)
 475 LET d1=INT (RND*19)+2: LET
a1=INT (RND*30)+1
 480 LET d=d1: LET a=a1: LET l=l
-1
 485 FOR i=b TO 8: PRINT AT r(i)
,c(i); INK 6;"T": NEXT i
 490 IF l>=0 THEN  GO TO 200
 500 REM game over
 505 PRINT AT 0,0; INK 6; PAPER
0;"(10*sp)score:";sc
 510 FOR i=30 TO -30 STEP -1: BE
EP .01,i: NEXT i
 520 PRINT AT 10,11; PAPER 0; IN
K 6; FLASH 1;"GAME OVER"
 560 IF sc>hi THEN  LET hi=sc: P
RINT AT 0,27; INK 6; PAPER 0; FL
ASH 1;hi
 580 PRINT AT 12,9; PAPER 0; INK
 6; FLASH 1;"Press any key"
 590 IF INKEY$="" THEN  GO TO 59
0
 595 GO TO 15
 600 REM countdown
 610 LET c=c-1
 620 LET t=INT (c/10): LET u=c-1
0*INT (c/10)
 630 PRINT AT r(b),c(b); INK 7;
BRIGHT 1;t$(t+1); OVER 1;AT r(b)
,c(b);u$(u+1)
 640 RETURN
 700 REM all safe
 710 PRINT AT 11,12; PAPER 0; IN
K 6; FLASH 1;"500 BONUS"
 720 FOR i=1 TO 2: PAUSE 5: BEEP
 .1,11: BEEP .1,11: BEEP .8,16:
BEEP .05,11: BEEP .05,16: BEEP .
05,11: BEEP .05,16: BEEP .8,20:
NEXT i
 730 FOR k=.1 TO 0 STEP -.01: BE
EP k,28: NEXT k
 740 LET sc=sc+500
 750 GO TO 20
 800 REM set up UDG's
 802 RESTORE 810: FOR i=0 TO 159
: READ a: POKE (USR "A"+i),a: NE
XT i
 805 RETURN
 810 DATA 14,10,10,10,10,10,10,1
4,4,4,4,4,4,4,4,14,2,2,2,14,8,
8,14,14,2,2,2,14,2,2,14
 820 DATA 8,8,8,10,10,14,2,2,14,
8,8,8,14,2,2,14,14,8,8,8,14,10,1
0,14,14,2,2,2,2,2,2,2
 830 DATA 14,10,10,10,14,10,10,1
4,14,10,10,10,14,2,2,14,64,64,64
,64,64,64,64,64,224,32,32,32,224
,128,128,224
 840 DATA 224,32,32,32,224,32,32
,224,128,128,128,160,160,224,32,
32,224,128,128,128,224,32,32,224
,224,160,160,160,160,160,160,224
 850 DATA 126,219,255,102,60,60,
39,224,126,219,255,102,60,60,228
,7,0,60,126,126,126,126,60,0,0,6
0,66,90,90,66,60,0
 900 REM insructions
 905 PAPER 0: INK 0: CLS
 915 PRINT
 920 PRINT  INK 6;"Race against
time to defuse all the mines bef
ore they explode.  Use the curso
r keys (5 TO 8) to move your bom
b expert Boris "; INK 3;"Q"
 930 PRINT  INK 7;"Defuse a mine
 by walking over itwhile it's co
unter is running.  DO NOT walk o
ver a mine when    it's counter
hasn't started "; INK 6;"T"'; IN
K 7;"because it will explode ,an
d    Boris will lose a life."
 940 PRINT  INK 4;"If Boris fail
s to reach a mine  before the co
unter reaches zero,then a chain
reaction will occurexploding all
 of the remaining  mines ,and en
ding the game."
 945 PRINT  INK 5;"PRESS ANY KEY
 TO START...."
 950 IF INKEY$="" THEN  GO TO 95
0
 960 RETURN
```



THE CHAMP

TAKE ON the mighty champ in a gruelling exhibition of ringside fisticuffs by Martin Warner of Mirfield, West Yorkshire. Animated boxers, and effective use of block graphics for the ring and spectators, give real punch to this game for the 16K ZX-81.

Full instructions are provided in the program — take care, because you may have to knock the champ down several times before you score a knockout.

```
  10 REM BOXING
  20 REM BY M.WARNER
  25 REM VARIABLES
  30 LET A=2
  40 LET B=15
  50 DIM A$(5,4)
  60 DIM B$(5,4)
  70 DIM C$(5,4)
  80 DIM D$(5,4)
  90 LET A$(1)="    "
 100 LET A$(2)="    "
 110 LET A$(3)="    "
 120 LET A$(4)="    "
 130 LET A$(5)="    "
 140 LET B$(1)="    "
 150 LET B$(2)="    "
 160 LET B$(3)="    "
 170 LET B$(4)="    "
 180 LET B$(5)="    "
 190 LET C$(1)="    "
 200 LET C$(2)="    "
 210 LET C$(3)="    "
 220 LET C$(4)="    "
 230 LET C$(5)="    "
 240 LET D$(1)="    "
 250 LET D$(2)="    "
 260 LET D$(3)="    "
 270 LET D$(4)="    "
 280 LET D$(5)="    "
 290 LET SC1=20
 300 LET SC2=20
 310 LET PUN=0
 320 GOSUB 5000
 330 LET KN1=0
 340 LET KN2=0
 341 REM RING
 350 PRINT AT 20,0;"                                "
 351 PRINT AT 13,21;"THE CHAMP ";TAB 21;"    V.";TAB 21;N$
 360 PRINT AT 17,22;" ";TAB 22;"  ";TAB 22;"  "
 370 PRINT AT 17,24;" ";TAB 24;"  ";TAB 24;"  "
 380 PRINT AT 17,26;" ";TAB 26;"  ";TAB 26;"  "
 390 PRINT AT 17,28;" ";TAB 28;"  ";TAB 28;"  "
 400 PRINT AT 17,30;" ";TAB 30;"  ";TAB 30;"  "
 410 FOR N=12 TO 15
 420 PRINT AT N,0;" ";AT N,20;" "
 430 NEXT N
 440 FOR N=16 TO 19
 450 PRINT AT N,0;"                     "
 460 NEXT N
 461 FOR N=0 TO 4
 462 PRINT AT N,0;"                                "
 463 NEXT N
 470 REM GAME
 480 FOR N=1 TO 4000
 490 PRINT AT 5,0;"SC=";SC1;" ";AT 5,16;"SC=";SC2;" "
 500 PRINT AT 11,A;A$(1);TAB A;A$(2);TAB A;A$(3);TAB A;A$(4);TAB A;A$(5)
 510 PRINT AT 11,B;B$(1);TAB B;B$(2);TAB B;B$(3);TAB B;B$(4);TAB B;B$(5)
 520 IF INKEY$="I" THEN GOTO 1000
 530 IF INKEY$="O" THEN GOTO 1100
 535 IF INT (RND*2)=0 AND B<A+4 AND B>A-2 THEN GOTO 700
 540 IF INKEY$="0" THEN GOTO 1200
 546 IF B<16 AND PUN=1 THEN GOTO 800
 550 IF B<16 AND B<A+2 THEN GOTO 800
 560 IF B>A+3 THEN GOTO 900
 570 IF SC1<1 THEN GOTO 9000
 580 IF SC2<1 THEN GOTO 9500
 699 NEXT N
 700 PRINT AT 11,B;D$(1);TAB B;D$(2);TAB B;D$(3);TAB B;D$(4);TAB B;D$(5)
 710 LET SC1=SC1-2
 720 IF A>1 THEN LET A=A-1
 730 PRINT AT 11,A+1;"    ";TAB A+1;"    ";TAB A+1;"    ";TAB A+1;"    "
 740 PRINT AT 11,B;B$(1);TAB B;B$(2);TAB B;B$(3);TAB B;B$(4);TAB B;B$(5)
 750 PRINT AT 11,A;A$(1);TAB A;A$(2);TAB A;A$(3);TAB A;A$(4);TAB A;A$(5)
 760 GOTO 570
 800 LET B=B+1
 801 LET PUN=0
 810 PRINT AT 11,B-1;"    ";TAB B-1;"    ";TAB B-1;"    ";TAB B-1;"    "
 820 PRINT AT 11,B;B$(1);TAB B;B$(2);TAB B;B$(3);TAB B;B$(4);TAB B;B$(5)
 830 GOTO 570
 900 LET B=B-1
 910 PRINT AT 11,B+1;"    ";TAB B+1;"    ";TAB B+1;"    ";TAB B+1;"    "
 920 PRINT AT 11,B;B$(1);TAB B;B$(2);TAB B;B$(3);TAB B;B$(4);TAB B;B$(5)
 930 GOTO 570
1000 IF A>1 THEN LET A=A-1
1010 IF A<1 THEN GOTO 545
1020 PRINT AT 11,A+1;"    ";TAB A+1;"    ";TAB A+1;"    ";TAB A+1;"    "
1030 PRINT AT 11,A;A$(1);TAB A;A$(2);TAB A;A$(3);TAB A;A$(4);TAB A;A$(5)
1040 GOTO 545
1100 IF A<16 THEN LET A=A+1
1110 IF A>15 THEN GOTO 545
```

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```
1120 PRINT AT 11,A-1;"     ";TAB
A-1;"     ";TAB A-1;"     ";TAB A-
1;"     ";TAB A-1;"     "
1130 PRINT AT 11,A;A$(1);TAB A;A
$(2);TAB A;A$(3);TAB A;A$(4);TAB
 A;A$(5)
1140 GOTO 545
1200 PRINT AT 11,A;C$(1);TAB A;C
$(2);TAB A;C$(3);TAB A;C$(4);TAB
 A;C$(5)
1210 IF A+3<B OR A>B+2 THEN GOTO
 545
1211 LET SC2=SC2-2
1215 LET PUN=1
1220 IF B<17 THEN LET B=B+1
1230 PRINT AT 11,B-1;"     ";TAB
B-1;"     ";TAB B-1;"     ";TAB B-
1;"     ";TAB B-1;"     "
1240 PRINT AT 11,B;B$(1);TAB B;B
$(2);TAB B;B$(3);TAB B;B$(4);TAB
 B;B$(5)
1250 PRINT AT 11,A;A$(1);TAB A;A
$(2);TAB A;A$(3);TAB A;A$(4);TAB
 A;A$(5)
1260 GOTO 545
5000 REM INSTRUCTIONS
5010 CLS
5020 PRINT AT 10,0;"          "
5025 PRINT AT 11,0;"          "
5030 PRINT AT 12,0;"          "
5035 PRINT AT 13,0;"          
[illegible]"
5040 PRINT AT 14,0;"          
[illegible]"
5045 PRINT AT 15,0;"          "
5050 PRINT AT 20,0;"ENTER YOUR N
AME BOXER"
5060 INPUT N$
5070 CLS
5080 PRINT "      [illegible]
[illegible]"
5085 PRINT
5090 PRINT "      [illegible]
[illegible]"
5095 PRINT AT 3,8;"[illegible]
[illegible]"
5100 PRINT
5110 PRINT " SO YOU THINK YOU CA
N BEAT THE  WORLD CHAMPION ,DO Y
OU ?"
5120 PRINT
5130 PRINT " WELL THE KEYS TO US
E ARE :-          PUNCH-      ""0"
"                 STEP BACK-    ""
I""                 STEP FORWARD-
""O"""
5140 PRINT
5150 PRINT "YOU ARE :-"
5160 FOR N=1 TO 5
5170 PRINT "             ";A$(N)
5175 NEXT N
5180 PRINT
5190 PRINT "GOOD LUCK"
5200 PAUSE 4E4
5210 CLS
5220 PRINT "BOXING TONIGHT-"
5225 PRINT
5230 PRINT "THE CHAMP V. ";N$
5235 PRINT
5236 PRINT
5240 PRINT "

"
5250 PAUSE 4E4
5260 CLS
5270 RETURN
8999 STOP
9000 FOR N=B TO 15
9010 LET B=B+1
9020 PRINT AT 11,B-1;"     ";TAB
B-1;"     ";TAB B-1;"     ";TAB B-
1;"     ";TAB B-1;"     "
9021 PRINT AT 11,B;B$(1);TAB B;B
$(2);TAB B;B$(3);TAB B;B$(4);TAB
 B;B$(5)
9022 NEXT N
9030 PRINT AT 11,A;"     ";TAB A;
"     ";TAB A;"     ";TAB A;"     "
;TAB A;"     "
9031 PRINT AT 13,A;" ";TAB A;"
"
9032 PRINT AT 15,A;"  "
9033 FOR N=1 TO 10
9034 NEXT N
9035 PRINT AT 13,A;"     ";TAB A;
"     ";TAB A;"     "
9040 PRINT AT 15,A;"   "
9055 FOR N=1 TO 10
9060 PRINT AT 5,9;N
9061 IF N=5 AND SC1=0 AND KN1<2
THEN GOTO 9110
9062 IF N=5 AND SC2=0 AND KN2<2
THEN GOTO 9110
9070 FOR M=1 TO 15
9080 NEXT M
9090 NEXT N
9100 IF SC1=0 AND KN1=2 THEN PRI
NT AT 6,9;"[illegible]"
9101 IF SC2=0 AND KN2=2 THEN PRI
NT AT 6,9;"[illegible]"
9109 IF KN1<2 AND KN2<2 THEN PRI
NT AT 21,0;"PRESS A KEY TO GET U
P ."
9111 IF KN1<2 AND KN2<2 THEN PRI
NT AT 21,0;"PRESS A KEY TO GET U
P ."
9112 PAUSE 4E4
9113 CLS
9118 LET B=15
9119 LET A=2
9120 IF SC2=0 THEN GOTO 9570
9130 CLS
9131 LET KN1=KN1+1
9132 IF KN1=3 THEN GOTO 9140
9133 LET SC1=20
9134 LET SC2=16
9135 GOTO 350
9140 PRINT "HARD LINES ,HE KNOCKE
D YOU OUT ."
9150 PRINT "THERE""S ALWAYS A AN
OTHER CHANCE"
9160 PAUSE 4E4
9170 RUN
9499 STOP
9500 FOR N=A TO 2 STEP -1
9510 LET A=A-1
9520 PRINT AT 11,A+1;"     ";TAB
A+1;"     ";TAB A+1;"     ";TAB A+
1;"     ";TAB A+1;"     "
9530 PRINT AT 11,A;A$(1);TAB A;A
$(2);TAB A;A$(3);TAB A;A$(4);TAB
 A;A$(5)
9540 NEXT N
9541 PRINT AT 11,B;"     ";TAB B;
"     ";TAB B;"     ";TAB B;"     "
;TAB B;"     "
9542 PRINT AT 13,B;"   ";TAB B;"
  ";TAB B;"  "
9543 FOR N=1 TO 10
9544 NEXT N
9545 PRINT AT 13,B;"     ";TAB B;
"     ";TAB B;"     "
9547 PRINT AT 15,14;"    "
9560 GOTO 9050
9570 LET KN2=KN2+1
9575 LET SC1=16
9580 LET SC2=20
9585 IF KN2=3 THEN GOTO 9600
9586 GOTO 350
9600 PRINT "BRILLIANT ,YOU REALL
Y SHOWED HIM"
9610 PAUSE 4E4
9620 RUN
9990 STOP
9991 SAVE "BOXING"
9992 RUN
```

Gossamer

GOSSAMER creates beautiful patterns for the QL using sets of straight lines to create spirals and helixes. For more complex patterns increase the value of j in line 50. For asymmetrical patterns delete line 170 from the listing.

Gossamer was written by Arthur Douglass from London.

```
10 MODE 8
100 WINDOW 512,256,0,0:PAPER 0:C
LS:BORDER 16,0
110 OPEN#3,CON_512x256a0x0:PAPER
#3,0:CLS#3:BORDER#3,16,0
120 a=RND(1 TO 140):b=RND(1 TO 1
00):c=RND(3):d=RND(3):IF NOT c A
ND NOT d:GO TO 120
130 e=RND(1 TO 140):f=RND(1 TO 1
00):g=RND(3):h=RND(3):IF NOT g A
ND NOT h:GO TO 130
140 INK_CHANGE
150 FOR j=1 TO 300
160 LINE a,b TO e,f
170 LINE#3,(148-a),b TO (148-e),
f:      REMark Remove this Line
   for a non            symmetrical
   pattern.
180 a=a+c:b=b+d:e=e+g:f=f+h
190 IF a>148 OR a<1:c=c*-1:INK_C
HANGE
200 IF b>100 OR b<1:d=d*-1:INK_C
HANGE
210 IF e>148 OR e<1:g=g*-1:INK_C
HANGE
220 IF f>100 OR f<1:h=h*-1:INK_C
HANGE
230 END FOR j
240 BEEP 10000,76:PAUSE 200:RUN
250 DEFine PROCedure INK_CHANGE
260 i=RND(1 TO 6)
270 INK i:INK#3,i
280 END DEFine
```

THE SOUND OF MUSIC



INCREASE the sensitivity of your eardrums and set the hills alive with a musical game for the QL by Frederic Huynh of Paris in France.

The Sound of Music plays a tune of eight notes and asks you to duplicate if from memory. At the end of the game you will be given a score based on the number of notes correct, and the computer will play both versions for comparison.

QL users may also find the numerical values for a scale useful, as the QL manual does not provide any information on the subject itself.

```
100 REMark DOREMI v.2-1
110 MODE 8
120 OPEN #4,scr_:WINDOW #4,442,2
00,38,16
130 PAPER #1,0:PAPER #2,0:CLS:CL
S #0
140      start
150 RESTORE :CLS
160      initialisation
170 CSIZE #0,3,1
180      octave
190 PAUSE 100:      ecoute
200 PAUSE 100:CLS# 0:      hasard
210      entree
220      CLS #0:compare
230      fin
240 IF ans=1 THEN PAUSE 10:PAUSE
 10:PAUSE 10:RUN
250 END IF
260 PAUSE 5:PAUSE 5:CSIZE #0,2,0
:CLS:CLS#0:STOP
20000 DEFine PROCedure initialis
ation
20010 RANDOMISE
20020 DIM a(9):DIM b(9):DIM resu
lta(9):DIM h(9):r=1:bon=0
20030 col=-30
20040 FOR i=1 TO 8
20050 READ a(i),b(i)
20060 END FOR i
20070 DATA 33,90,28,80,24,70,22,
60,18,50,15,40,12,30,11,20
20080 RETurn
20090 DEFine PROCedure octave
20100 AT #0,1,2:PRINT #0;"  List
en to the scale"
20110 x=20
20120 FOR i=1 TO 8
20130 BLOCK 30,b(i),x,100-b(i),i
:x=x+50
20140 BEEP 10000,a(i):PAUSE 20
20150 END FOR i
20160 RETurn
20170 DEFine PROCedure ecoute
20180 AT #0,1,4:PRINT #0;"   One
 more time      "
20190 FOR i=1 TO 8
20200 BEEP 10000,a(i):PAUSE 20
20210 END FOR i
20220 RETurn
20230 DEFine PROCedure hasard
20240 AT#0,1,4:PRINT #0;" Now ,
Listen to the score"
20250 FOR i=1 TO 8
20260 h(i)=INT(RND(1 TO 8))
20270 BEEP 10000,a(h(i)):FOR z=1
 TO 200:NEXT z
20280 END FOR i
20290 PAUSE 100:AT #0,1,0:PRINT
#0;"      Last audition !      "
20300 FOR i=1 TO 8
20310 BEEP 10000,a(h(i)):FOR z=1
 TO 200:NEXT z
20320 END FOR i
20330 RETurn
20340 DEFine PROCedure entree
20350 INK #0,3:AT #0,1,0:PRINT #
0;"   Enter your solution ":INK
 #0,7
20360 y=20
20370 BLOCK 30,5,y,100,2
20380 IF KEYROW(1)=16 AND y<370
THEN y=y+50:BLOCK 30,5,y-50,100,
0:BLOCK 30,5,y,100,2
20390 IF KEYROW(1)=2 AND y>20 TH
```

```
EN y=y-50:BLOCK 30,5,y+50,100,0:
BLOCK 30,5,y,100,2
20400 IF KEYROW(1)=8 THEN CLS:CL
S #0:STOP
20410 IF KEYROW(1)=1 THEN FOR zz
=1 TO 50:NEXT zz:GO TO 20430
20420 GO TO 20380
20430 note=((y-20)/50)+1
20440 col=col+50
20450 resulta(r)=note:r=r+1
20460 BLOCK 30,b(note),col,200-b
(note),note
20470 BEEP 10000,a(note)
20480 IF col>=370 THEN RETurn
20490 GO TO 20380
20500 RETurn
20510 DEFine PROCedure compare
20520 PAUSE 100:PAUSE 10
20530 INK #0,2:AT #0,1,0:PRINT #
0;"  Here are the results"
20540 PAUSE 150
20550 y=20
20560 SCROLL -105
20570 INK #0,1:AT #0,1,0:PRINT #
0;"         Your score        "
20580 FOR i=1 TO 8
20590 BEEP 10000,a(resulta(i)):P
AUSE 20
20600 END FOR i
20610 PAUSE 100
20620 CLS #0
20630 INK #0,4:AT #0,1,0:PRINT #
0;"  And the computer's one"
20640 FOR i=1 TO 8
20650 BLOCK 30,b(h(i)),y,200-b(h
(i)),h(i)
20660 BEEP 10000,a(h(i)):PAUSE 2
0
20670 y=y+50
20680 IF resulta(i)=h(i) THEN bo
n=bon+1
20690 END FOR i
20700 RETurn
20710 DEFine PROCedure fin
20720 PAUSE 100
20730 INK #0,7:AT #0,1,0:PRINT #
0;"     Results of the test     "
20740 PAUSE 100
20750       couic(5)
20760 FLASH #0,1:AT #0,1,0:PRINT
 #0;"       Good answers : ";bon:
PAUSE 100:       couic(-5):FLASH #
0,0
20770 AT #0,1,0:PRINT #0;" Do yo
u want another play ?":PAUSE 50:
      couic(-5)
20780 FLASH #0,1:AT #0,1,0:PRINT
 #0;"        Press Y or N    ":FL
ASH #0,0
20790 IF KEYROW(5)=64 THEN ans=1
:GO TO 20820
20800 IF KEYROW(7)=64 THEN ans=0
:GO TO 20820
20810 GO TO 20790
20820       couic(-5)
20830 RETurn
20840 DEFine PROCedure couic(v)
20850 FOR i=#0 TO 120
20860 PAN #0,v:END FOR i
20870 RETurn
20880 DEFine PROCedure start
20890 CLS:CLS #4
20900 BORDER #4,3,1,4
20910 CLS #4
20920 INK #4,2:AT #4,0,11:PRINT
#4;"FFREDERIC HUYNH"
20930 INK #4,1:AT #4,3,15:PRINT
#4;"PRESENTS"
20940 INK #4,3:CSIZE #4,3,1:AT #
4,3,10::PRINT #4;"DO-RE-MI":CSIZ
E #4,2,0:INK #4,4
20950 AT #4,10,0:PRINT #4;"  Thi
s program is very easy to use :
you will hear a series of notes
;then the principle of the game
is  to remember them."
20960 AT #4,14,0:PRINT #4;"  Use
 the cursor keys to select theno
tes and then press <ENTER> to re
-cord them."
20970        music
20980 INK #4,3:CSIZE #4,3,1:AT #
4,3,10:PRINT #4;"DO-RE-MI":CSIZE
 #4,2,0:INK #4,4
20990 INK #4,6:FLASH #4,1:AT #4,
18,12:PRINT #4;"PRESS <ENTER>":I
NK #4,4:FLASH #4,0
21000 IF KEYROW(1)=1 THEN PAUSE
10:PAUSE 10:RETurn
21010 IF KEYROW(7)=4 THEN GO TO
20890
21020 IF KEYROW(1)=8 THEN CLS:ST
OP
21030 GO TO 21000
21040 RETurn
21050 DEFine PROCedure music
21060 RESTORE 21120
21070 FOR i=1 TO 64
21080 INK #4,i:CSIZE #4,3,1:AT #
4,3,10:PRINT #4;"DO-RE-MI":CSIZE
 #4,2,0
21090 READ n,t:BEEP t+5000,n:PAU
SE 7*(t/1000)
21100 END FOR i
21110 :
21120 DATA 33,3000,28,1000,24,30
00,33,1000,24,2000,33,2000,24,40
00,28,3000,24,1000,22,1000,22,10
00,24,1000,28,1000,22,5000
21130 DATA 24,3000,22,1000,18,30
00,24,1000,18,2000,24,2000,18,40
00,22,3000,18,1000,15,1000,15,10
00,18,1000,22,1000,15,5000
21140 DATA 18,3000,33,1000,28,10
00,24,1000,22,1000,18,1000,15,50
00,15,3000,28,1000,24,1000,20,10
00,18,1000,15,1000,12,5000
21150 DATA 12,3000,24,1000,20,10
00,17,1000,15,1000,12,1000,11,50
00,12,1000,14,1000,15,2000,22,20
00,12,2000,18,2000,11,5000
21160 DATA 33,1000,28,1000,24,10
00,22,1000,18,1000,15,1000,12,10
00,11,1000
21170 RETurn
21180 END DEFine
21190 STOP
```

LiNe TrAcE

TAKE THE PAIN out of de-bugging ZX-81 programs with **Line Trace** by Barry Nicholson of Tyne and Wear. The program is a short machine-code routine which uses interrupts to constantly monitor the operation of a Basic program.

First, enter POKE 16389,127 to lower RAMTOP. The LOAD the program and RUN it. The code will be POKEd in and the program will then NEW. Now you can write your Basic program. Typing RAND USR 32512 will activate the routine, and when your program is RUN the line numbers will be printed at the bottom of the screen as they are executed. RAND USR 32517 turns the routine off.

The routine will happily deal with any Basic program unless it uses the commands FAST or PAUSE.

```
  10 REM ZX81 TRACE    1984
  20 SLOW
  30 PRINT TAB 3;"NOW LOADING AB
OVE RAMTOP",,,"ZX81 TRACE",,"BY B
.NICHOLSON",,,"COMMANDS:-",,,,"T
RACE ON .. RAND USR 32512",,"TRAC
E OFF.. RAND USR 32517",,,"WHEN
SCREEN CLEARS,LOAD IN YOUR BASIC
 PROGRAM."
  35 REM 1
  40 LET A$="DD216A7FC9DD2181020C
9E80364000A0001002A34402E3E7FA4B
57C20003171802463767223440D0"
  45 REM 2
  50 LET A$=A$+"CDBB02ED4B254022
254078C602ED423A27404B55806 0B21
3B40CB8620080B7ECBC6C8"
  55 REM 3
  60 LET A$=A$+"0500372127403FCB
1010FE467BFEFE9F061FB6A01F77D3FF
2A0C40CBFCCD7B7FED5F010119"
  65 REM 4
  70 LET A$=A$+"3EF5CDB5022BCD7B
7FC3127FDDE1FD4E28FDCB3B7E2000 3E
FC0601CDB5022BE3E3DDE9"
  75 REM 5
  80 LET A$=A$+"79ED443C08D3FEDD
E53A0840C87F2807DDE1E1D1C1F1C9DD
2A0C4011D702DD192A0740110A7F"
  85 REM 6
  90 LET A$=A$+"1A4F131A47AFB7ED
4238033C18F909C61CDD7700DD2379FE
01280313 18E20E0205DC10FE0D28C318
F7"
 100 REM  (PRINT LEN A$)
           SHOULD GIVE:- 450
 105 REM ******
 110 LET B=32512
 120 FOR K=1 TO LEN A$ STEP 2
 130 POKE B,16*(CODE A$(K)-28)+C
ODE A$(K+1)-28
 140 LET B=B+1
 150 NEXT K
 160 NEW
 170 SAVE "TRACE"
 180 LET RT=32512
 190 IF (PEEK 16388+256*PEEK 163
89)=RT THEN RUN
 200 PRINT "RAMTOP NOT LOWERED T
O ";RT,,,"PLEASE LOWER RAMTOP BY
:-",,,"  POKE 16389,127....NEWLI
NE",,,"FOLLOWED BY  NEW....NEWLI
NE",,,"THEN RELOAD ""TRACE"""
```


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Quick to learn, easy to use, that's

MINI OFFICE marks a long-awaited breakthrough in dramatically reducing the cost of personal computing.

For the first time it makes available to everyone an easy-to-operate version of four of the most popular business computing applications – and at a price anyone can afford.

Never before has a word processor been sold for anything as low as £5.95. Nor a database manager. Nor a spreadsheet. Nor a graphics program.

Yet Mini Office contains them all.

So how was it done?

It all started with a suggestion that we should prepare a package to give readers a gentle introduction to the kind of software that businesses were running on their computers.

At that stage there was no intention that it should be an ambitious package. Just a simple program that could be sold at a very low price.

We called in experts in business software programming, told them what we wanted and sat back to await results.

What happened next was totally unexpected. For they all came back with ideas that were to considerably expand our original brief.

In the end what had been planned as little more than a beginners' guide to word processing, database management, spreadsheets and graphics had been turned into a full scale suite of programs covering all four applications.

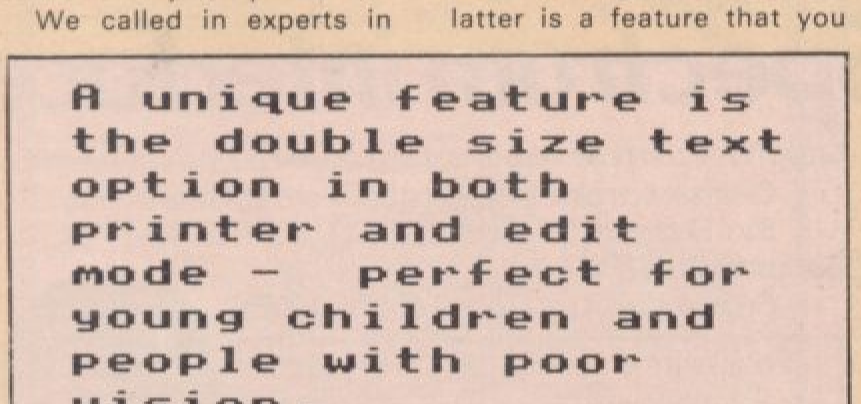
In fact the only part of the brief that remained was our original insistence that the package should be quick to learn and easy to use.

And despite all the extra sophistication that has been written into it, we decided that, as a service to our readers, the price should still be kept at the very low figure originally fixed.

How does Mini Office operate?

Using the **Word Processor** is simplicity itself. There are none of the cryptic coded instructions that had to be mastered by people learning the early word processors.

You start by selecting the size of type you prefer – either normal or double-size. The latter is a feature that you cannot find on any other word processor.

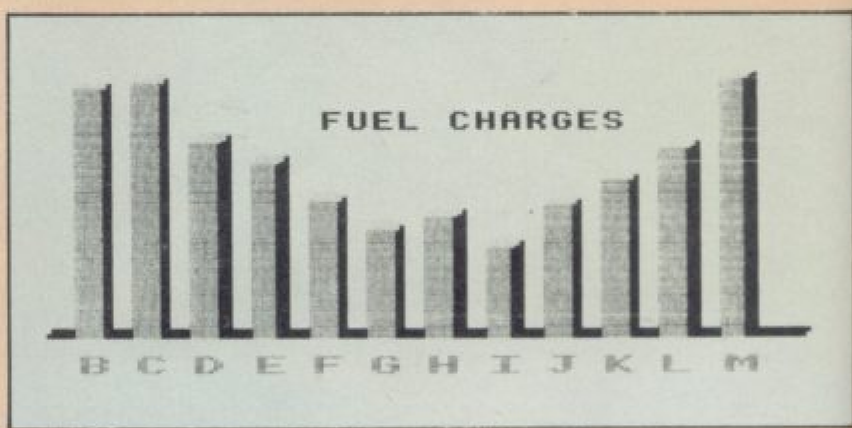


The word processor – with double size characters

It is particularly suitable for the partially sighted – in many cases giving them their very first opportunity to use a word processor.

This means they can use a micro to compose a letter, using the double-size mode, and then print it out using normal size type. For many people this could be the first time they can send out a perfectly typed letter without outside help.

Primary school teachers are also expected to make great use of the double-size function, both on the screen and on hard copy printouts.



Figures on the spreadsheet can produce a bar chart . . .

While you are using the word processor three useful pieces of information are displayed across the top of the screen.

They tell you how much time has elapsed since you started using it, the number of words you have written so far, and how many characters you can key in before the computer's memory is full.

At any time you can press a key which tells you your typing speed. This is a most useful function, and can play an important part in increasing your efficiency at the keyboard.

You can also decide the size of the margin, the line length and the tab positions. Text can be moved from one part of the document to another.

At any time you can preview the text to see how it would look when printed out.

As with all the other programs in Mini Office, your work can easily be saved and loaded when you want to use it again. It can also be printed out.

The **Database** program can be used to store a mass of information. It can be retrieved, in its entirety or just the parts you require for a particular purpose, whenever you need it.

The operation is so simple that a useful database can be created in minutes rather than days – and you certainly don't need any computer experience to set it up.

The powerful search facility is very easy to use. You can search for a particular word or words or you can order a numeric search – such as telling the computer to find all the numbers greater or less than the one you provide.

You can carry out multiple sorts. For instance, if you have built up a mailing list containing a list of names, addresses, telephone numbers, occupations and ages you can ask the database to provide you with a list of teachers living in Liverpool whose ages range from 25 to 30.

One powerful option allows you to replace anything on the database without having to go through the whole lot making amendments yourself. You could, for instance, instruct it

Now on the 48K Spectrum and Spectrum +



to find each reference to "teacher" and replace it with "lecturer".

The **Spreadsheet** is our version of the program that marked a milestone in business computing – Visicalc.

It is often pointed out that this one program alone has helped to sell more personal computers than any other.

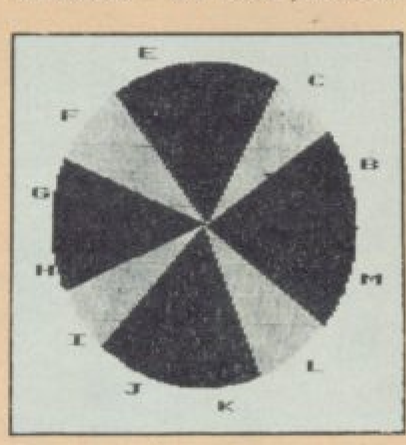
Certainly Visicalc and its derivitives have never been shaken from their position at the top of the list of best-selling business programs.

Yet the concept is very simple – a giant worksheet of rows and columns, only part of which can be seen on your screen at any one time. Into any position on the sheet you can put numbers, labels and mathematical formula.

And when you alter any figure its effect ripples through the rest of the sheet, changing any totals as may be necessary.

The Mini Office version is ideal for home finance, providing you with an effortless means of keeping tabs on your income and expenditure – and enabling you to work out your own budget.

In our Spreadsheet program – as well as in the Database – we have provided



. . . or a pie chart

a sample file so that you can experiment with it before entering your own data.

One feature we have included which to our knowledge does not exist in any other spreadsheet is a warning device to prevent you accidentally erasing formula – a very useful precaution.

The **Graphics** program uses the standard business graphics – line, bar and pie charts – in full colour. Which is something not always available on far more expensive graphics packages.

The program uses data you have already prepared on the spreadsheet. You have to identify which set of information you require to see in graph form – such as by indicating which row or column – and then which of the graphs you require.

The graph is then automatically configured exactly as you require it. If you have suitable printer capable of producing graphics you can also print out hard copies for a permanent record.

Because our original intention was to produce a package for people new to all these applications, we have produced a fully-detailed, easy to understand manual.

This 32 page free booklet gives clear instructions about how to use all four programs and in itself forms a concise introduction for first-time users.

If you want to start doing more with your micro than just playing games, this package is your ideal introduction to the four most popular applications for professional computers.

● *Graphics illustrated here are from the Amstrad version and are slightly different on the Spectrum version.*

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Not one but three Omnibots are going as prizes to the winners of our Ultimate competition. And those three will also receive a fabulous Ultimate goody bag, with an anorak, two T-shirts, a cap, a sweatshirt, and a hooded track-suit top, all with the Ultimate logo, plus eight posters and a voucher for a free Ultimate game of your choice. And even if you miss out on the first prize, the seven runners-up will all receive a goody bag anyway.



With the Omnibot retailing at £180, and the goody bag worth at least £70, that makes more than £1200 worth of prizes. So how do you get your hands on them?

All you have to do is find the titles of nine Ultimate games. Pretend for a moment that you are one of the space colonists in the game Alien 8. Before you joined the ship, you were just another asteroid belt smuggler hiding out in the warrens of Mars. Then you heard about a cheap passage going to a new star system. You arrange to meet the man with the ticket to sell in a dingy bar on Phobos spaceport . . .

Below are the words he spoke to you. Hidden within what

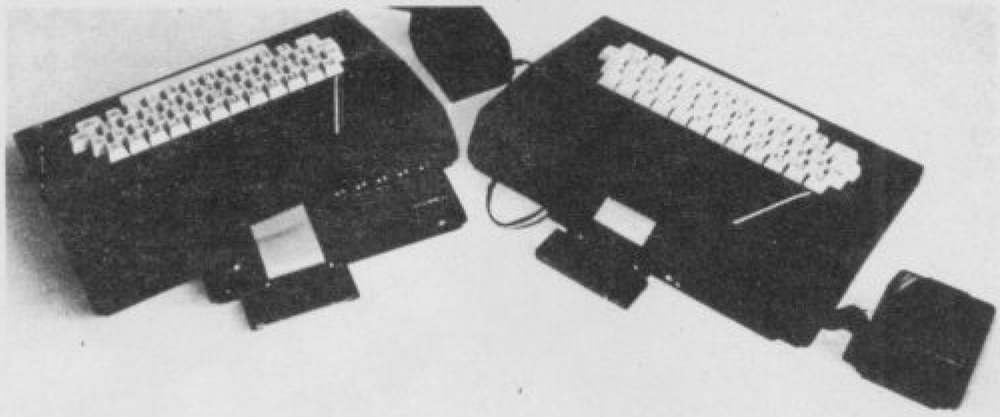
"Psst! One ticket for a lunar jet, man, going cheap. And since you're evidently from the underworld of Mars, you'll have to go by night. Law is inoperative once you're aboard. Flight ZX742, Trans-American Spaceways. Take a tip from an old space-hound, be a smart cookie. Before you board the jet, pack your light-sabre. Wulf the manic miner may be aboard; a dangerous man, most space-piratic. Attack him on sight if you smell a rat. Good luck!"

he said are the names of nine Ultimate games – beware, they are not always spelled correctly. Write down the nine titles, correctly spelled, and then think of a suitable caption for the comical picture above.

The competition will be judged by Ultimate, and the winners will be those who correctly identify the nine games, and in the opinion of the judges, provide the best caption to the picture. All entries must be sent to Ultimate Competition, Sinclair User, Priory Court, 30-32 Farringdon Lane, London EC1R 5BH.

Employees of EMAP, Ultimate, their friends and associates, are not allowed to enter. All entries should be received by Friday 17th May, and should be written on postcards.

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  - DELETE key
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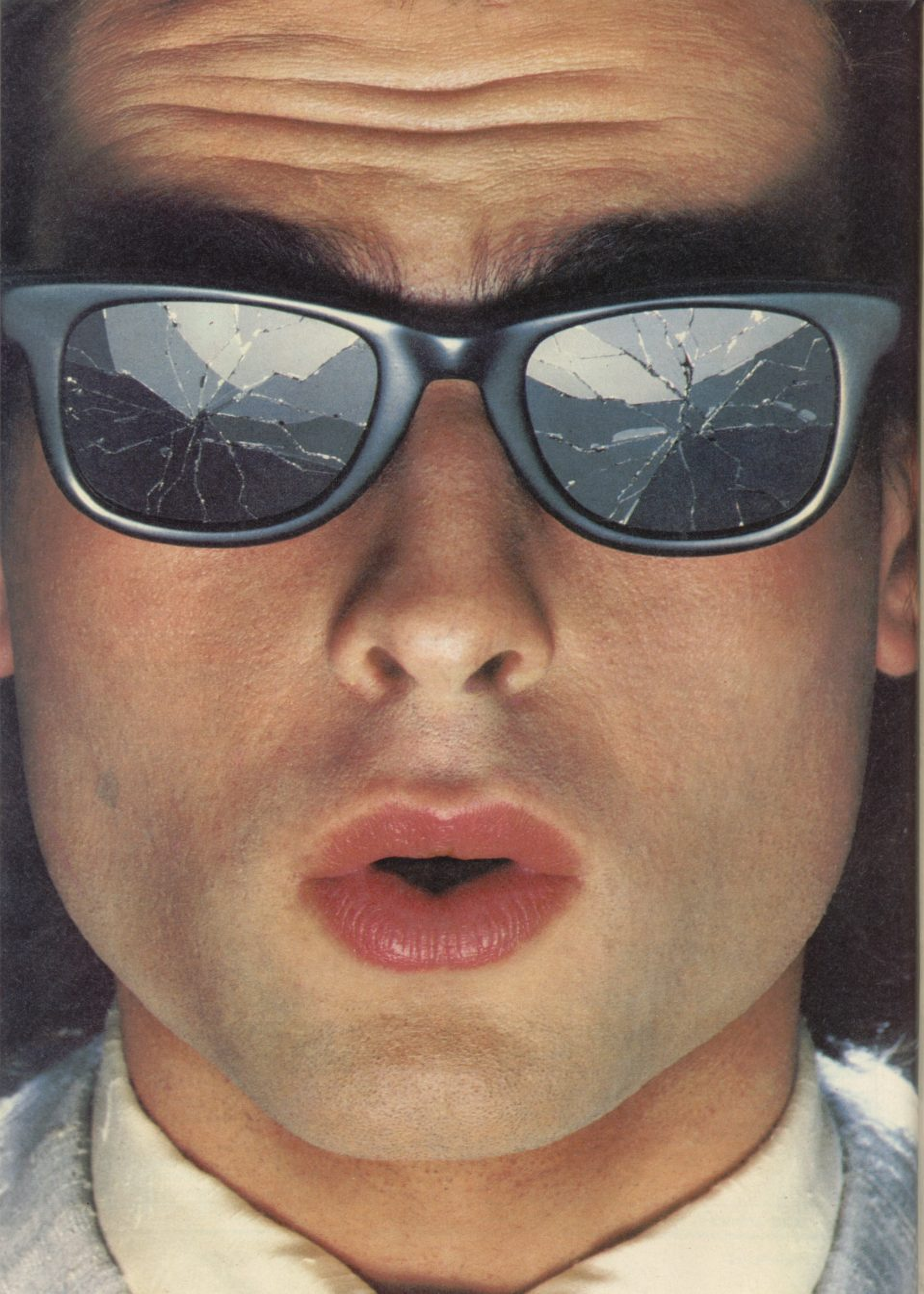
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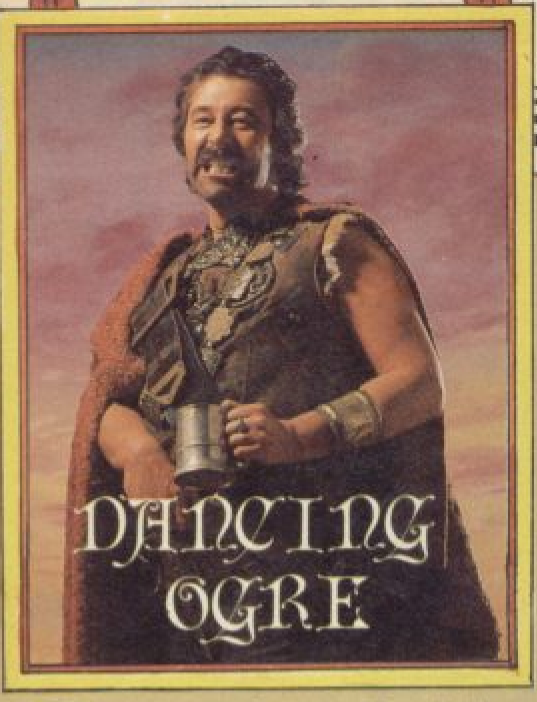
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Greetings from Greatbelly, friends! There are indeed some strange sights on the road to my destiny at Maru. About four days south of the Ogre, in the Urunnar plains below the Eshakani mountains, we came across seven men, clad all in white with red wigs, who sat in little white carts which moved as if by magic.

They told me they were acolytes of the monastery of Seefayv the Red One, who had bid them go forth into the world to tell men they need never walk again, nay not even unto the alehouse.

Regrettably, Zul and Zel, who led the baggage train behind me, being somewhat myopic failed to see them. Before I could shout they over-ran these holy men. Now there are only six to spread the joyful tidings. Fate is a harsh mistress — perhaps this martyrdom may toughen their resolve.

At Samarrak we stopped for the night at the Damaged Dragon, a poor place where the porridgey food would not sustain a flea. After eating, Zul and Zel found their way to the cow-byre whilst I joined some travellers coming up from Urtuun to the south.

As we caroused, Mangler Morrow of Liverpool and Ashen Face Ashley from Banbury bewailed their ill luck in finding their way to the **Lords of Time**. One could not recover some keys from beneath a door. A lodestone or magnet might be some help — some narcissistic whelp may offer one for a mirror or so I have heard.

The other sought a tiger's tooth. I suggested he seek a tiger — naturally — in the depths of prehistory. Aiding an animal with toothache can often bring useful results.

Along with these two rode Noel the Slayer of Kidderminster. Stumped he was in his **Dungeon Adventure** and unable to pass a giant rat. There is nothing so abhorrent to these rodents as rancid or stinking chips. Mere possession of one may well drive off the creature. He also wanted arrows for a bow he had found. When I was there I swear there were none, though I will accept correction.

Farseeker Forsyth, boasting in his beer, claimed to us all that he had solved all the riddles of **System 15000**. He claims the title of Lord High Systems Breaker. Others will wish to prise some knowledge from him. Write to him, remembering to pay the courier's fee in advance, at 31 Somerset Road, Kingston, Surrey.

Fair Karen Mear asked advice of me about this ritual — she cannot force her way into the Midminster Bank. At Seastar Travel she will find a code to help her entry. Fair foreign exchange is no robbery.

An illegible hieroglyphic student from Sulgrave, Washington had been bemused and benighted on the **Invincible Island**. In his possession was a sword and skull but he could see no use for them. Perhaps he has had difficulty in escaping the angry islanders — he will be pleased to know that these items will give time to slip away in safety with the booty. He also could see no purpose in the boulders that bestrew the isle; well, dropping them in holes will show the presence of water, which could be dangerous.

Gordo witnesses death on the road to Maru. All, and more, is related

Owen of the Oval Sphere from Bangor had tried long and hard to enter a town hall in ill-famed Scarthorpe home of the **Urban Upstart**. Beware bureaucrats young sir — all they need is red tape. Take some with you.

There were two far travellers at a corner table. Koster the Accoster of Rhenen in the Low Countries had wearied himself in pursuit of the **Golden Baton**. He could not take hold of a glowing crystal and was in despair. Fear not, says I. Have with you a staff and ring before entering the castle. Until you don a helm found inside the fortress, you may not read the runes inscribed upon the staff. When you read them they should spell 'Akyrz'. Waving the staff and saying this potent charm will cause the ball to dim and drop.

With Koster was one Caballero Carvalho of Lisbon. On learning my name he told me that Gordo in his tongue meant 'the fat one'. Stout is a word I might prefer . . .

At this point Sir Matthew Hill of 20 Mill Road Newthorpe in Nottingham got up upon a table and proclaimed, "I have attained **Hampstead**! Pippa and I would like to let you know we are settling in at our £100,000 cottage. I'm doing well in my work as advisor to the government and you may see me cycling along the Heath in my trusty tracksuit."

Though tankards were thrown there were many who pondered well these words. Richard the Evilcleaver of Poole (24 Hour Service) asked me in a whisper how to enter the gothic mansion owned by Pippa's father. Hark . . . when the toady butler speaks, merely ask to 'meet Chubby'. No second chance is given. Evilcleaver offers help with **Hampstead** and **The Hobbit**. Reach him at 81 Surrey Road, Branksome, Poole, Dorset.

Marauding Marc of Worcester had constantly tried to cross a river in search of the **Tower of Despair**. An angel of death blocks his path. Leaving by a back door may help. Search the bodies there and also the barrels — a key and holy dagger may appear and be of use. If all else fails then try sneak tactics and creep angel. Clear as day.

Gunman Guntrip of Abingdon has not rested from **Valkyrie 17**. He cannot obtain the lamb from the savage butcher. Do you remember a lead box, Gunman? Fatal to you, it may equally be so to this terrible tradesman.

There were a large group, including Ironfist Arends of Hitchin and Whetstone Sharp of York in trouble assisting **Sherlock** Holmes. Some could not enter Basil's house in London. On Tuesday or Wedneday this evildoer is in residence in the great city, and a window in the back yard should be open. Look through to see if Basil is asleep and enter safely.

Now the safe in Basil's other house. Wait for him to leave for London on Tuesday and force your way in. To those who ask me how to open the safe — why not say 'Open safe'?

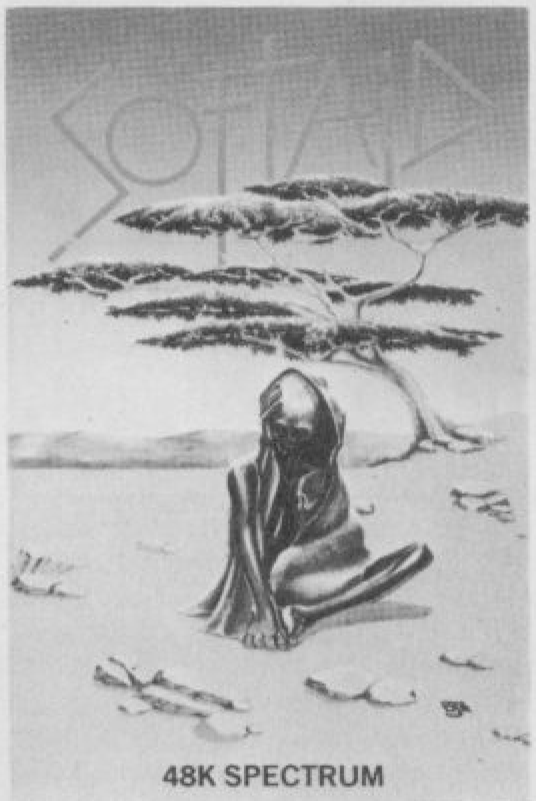
A tiring night it had been. Besides, I hear that the Lady Marion has written letters to a certain Grand Elf. I am desolate. 'Til next moon, farewell companions of the road.

Greatbelly

If you have a tale to tell, or are in need of a helping hand, write to the Landlord of the Dancing Ogre c/o Sinclair User, Priory Court, 30-32 Farringdon Lane, London EC1R 5BH.

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Sleuthing by the sea

Richard Price unearths a devious detective puzzle

THE RAIN dribbled down the grimy windows as I sat at my VDU, listlessly dabbling in some computer saga of wizards and dark castles. The day had been empty of excitement. Suddenly the post boy appeared and threw a package onto my littered desk.

I felt a thrill of apprehension as I took the buff folder from the envelope and saw 'Confidential' stamped in red across it. Could this be it, I thought — had some disgruntled civil servant decided to leak the secrets of the nation's war games computer to me?

Not quite. The folder held a map of a seaside town called Fox Bay, a detective's notebook and a cassette. After playing for a short time I found I had one of the most entertaining Quilled programs since **Hampstead.**

Confidential

Confidential is a detective adventure. One of Fox Bay's prominent citizens has disappeared and his wife decides to hire you, Craig Adams, to track him down. From your seedy office you must seek out the man's associates and contacts to build a coherent picture of the facts surrounding the disappearance. This is not a simple matter. Besides gathering information, often from reluctant characters, there are the hazards of day to day life in the town.

Holiday caravans moulder on sites which are veritable labyrinths. Your car will run out of petrol if you are not careful. You will leave some office in the town centre smugly thinking how good your interview was only to find a pair of yellow lines where the car had been. All right, stroll up to the local nick to get it back. Have you got your cheque book? You will have to find it then, won't you?

Radar Games has used the **Quill** with some originality and has developed a flair for making you think you're doing well and then bringing you up short with a new twist in the plot.

The screen presentation is attractive and makes full use of the various attributes on the **Quill.** There are small user-defined graphics which add to the professional feel of the game.

Movement is based on the road map provided and you are expected to pay close attention to it if you want to get around town successfully. This feature adds considerably to the atmosphere of the game. After a while you will begin to feel like a true, harassed, gumshoe — someone who no-one particularly likes or enjoys talking to.

Your problems begin the moment you start playing and there is no real let up. Some of the puzzles are relatively easy but they get tougher as you go along. What's really a change is that the game has continuity in its story line and doesn't simply expect you to be satisfied with just collecting objects or treasure.

As far as I know **Confidential** is only available by mail order — but do not let that put you off. It is far better

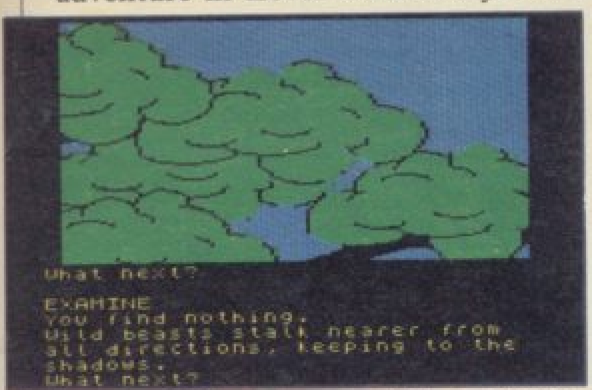
than a lot of the pap in the chain stores now. Write to: Radar Games, 53 Flavel Street, Woodsetton, Dudley DY1 4NU.

Emerald Isle

The Bermuda Triangle is a far call from the more prosaic charms of an English holiday resort. In **Emerald Isle** by Level 9 you find yourself hanging by your parachute cords after your plane has been destroyed by the strange forces at work in that part of the world.

Around you is the tropical forest of the island. Only one person may ever leave this place — the ruler of the land — and your aim is to amass the treasures needed to attain this pinnacle of social status. When you've collected them you must work out the correct method to become king.

The program is another graphic adventure in Level 9's new style and



boasts 200 pictures with a similar number of locations. To be frank, many of the pictures add precious little to the game and I could quite happily have done without graphics showing the bare walls of a room or an expanse of sand.

Despite the graphic overload there are still the kind of descriptions and complexities which adventure veterans expect from the company. Even though Level 9 state specifically that **Emerald Isle** is an easier game than usual — and costs correspondingly less — the clue sheet still runs to over 500 items.

After extricating yourself from the parachute you make your way to the royal palace in Tree City. There you will begin to get some idea of the way the island operates and should find the railway which can transport you to other parts.

I was quickly befuddled by the vast amount of detail — this initial sense of bewilderment seems to be one of Level 9's hallmarks. There is never a simple progression from one easily solved puzzle to another. You never know whether an item you find will have one or many uses, and the wealth of information helps develop involvement and atmosphere.

The island setting is becoming a classic scenario for adventures but it is not often that you get quite so much for your money. As well as the mandatory volcano, natives, cannibals and coconuts to deal with, you will have to know what to do with carbide granules, ticket machines and lots more.

At £6.95 **Emerald Isle** is competitively priced and offers a style and sophistication hard to beat. If you're already a committed Level 9 fan you're unlikely to be disappointed, even if it is easier than usual. I'm still trying to read those damned foreign inscriptions.

Heroes of Karn

I loaded up **Heroes of Karn** from Interceptor with trepidation. I found the earlier program **Jewels of Babylon** about as exciting as Eastbourne on a Sunday night. Fortunately, the new adventure is a different kettle of fish, though with some reservations.

The setting is pretty typical — the mighty heroes of the title have been overwhelmed by the dark forces of chaos and magically imprisoned in various forms. You, a stranger from a world of thinking machines and the like, must rescue them from the thrall of darkness and restore them to their true likenesses. I'm unsure about the thinking machine bit but we all accept a modicum of poetic licence now and again, I suppose.

The game is a graphic adventure and there are some very smart pictures sprinkled around the locations — probably not as many as in the original CBM 64 version but beautifully drawn nevertheless. However, pictures still do not make an adventure.

You start in a field in a deserted landscape. Problems appear quickly and it is not too long before you run into what is undoubtedly the first of the metamorphosed heroes — a frog no less, who can be transformed in the time-honoured way after you have disposed of a particularly irritating swamp lizard. Within a score of moves you meet barrowights, venal castle guards, a pirate and even a giant clam.

Like its bejewelled predecessor the program's general style can be aggravating. The description will scroll up, up and away as soon as you make an entry, making for a lot of retyping of



'Look' if you are of vaguely amnesiac dispositions. On the positive side, you can use prepositions such as 'with' enabling you to choose a weapon for a fight or offer items of bribery to creatures of all species.

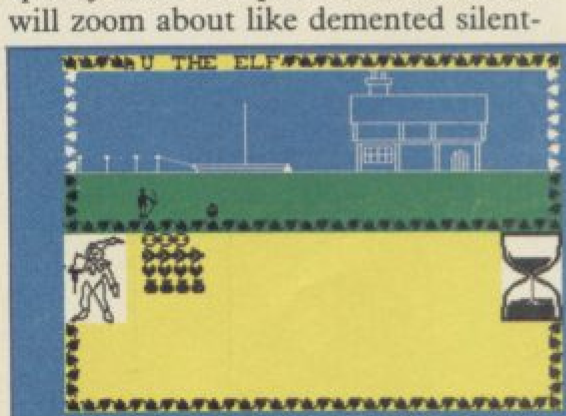
Allies can also be spoken to in an easier way than in truly 'interactive' games though the characters do not lead fully independent lives. I must admit that this is a bonus as I find the behaviour of characters in games like **The Hobbit** to be desperately unpredictable and annoying.

As far as action and events are concerned **Heroes of Karn** is an improvement on Interceptor's earlier offerings. It does not compare in complexity with the Level 9 style but should be quite appealing to adventurers in their novitiate.

The Talisman

Games Workshop define **The Talisman** as an interactive multi-player arcade adventure. Up to four players can take part, each one choosing a role from a set of 10 stock dungeons-and-dragons cast members — elf, assassin, sorceress, thief and so on. If you play on your own you can nominate up to three other computer-run characters or just go solo.

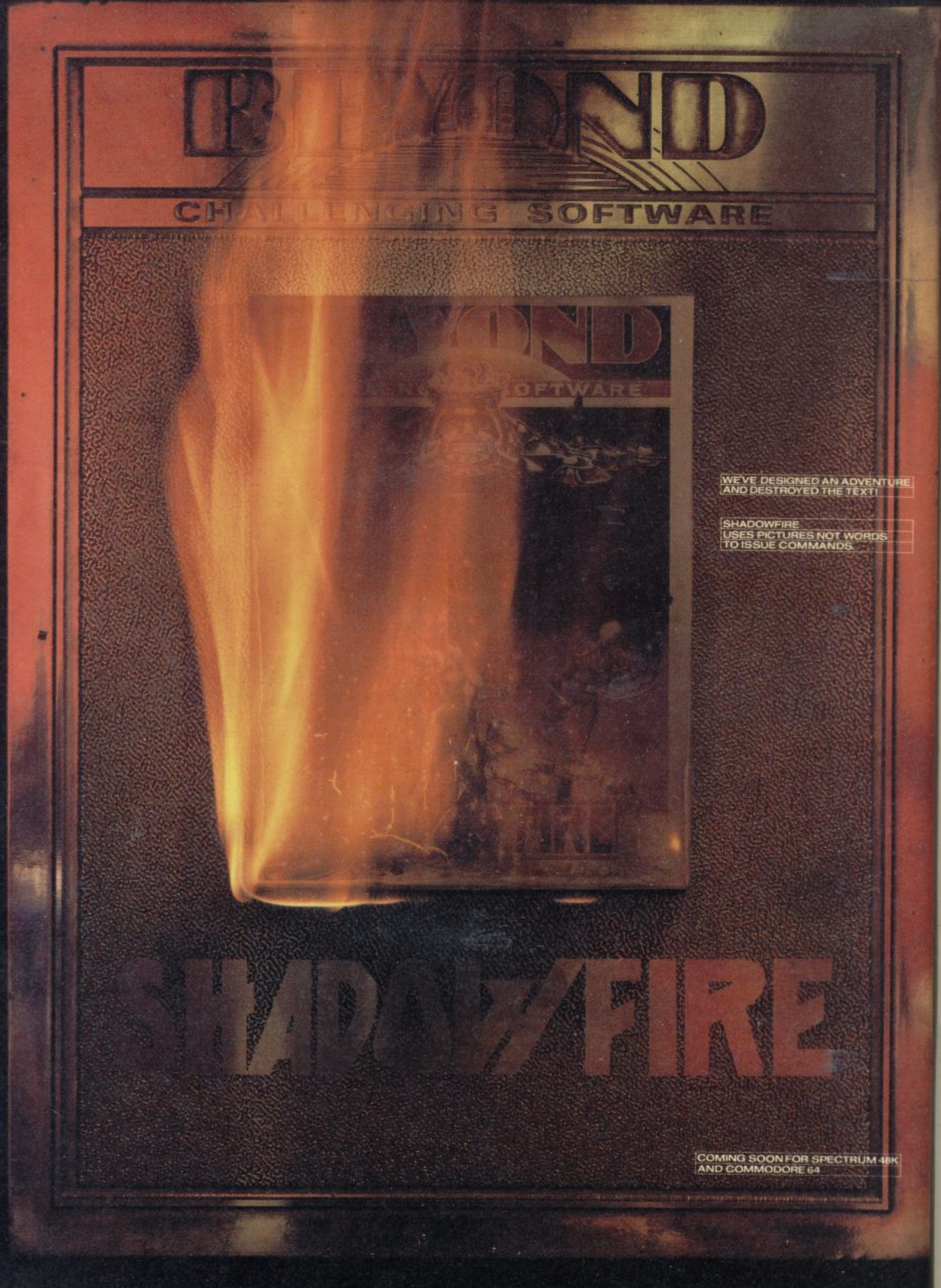
There are three playing speeds — laid back, moderate or speedy. In the speedy mode computer-run characters will zoom about like demented silent-



film stars and only experts should enter this fast motion world.

Although the cassette blurb likens the game to **Valhalla** there is no

continued on page 115


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continued from page 113

proper text input and most decisions and actions are performed by single key-presses.

The screen is split into two major sections. Up top is the location picture and the path on which the characters move about. Below are the various status indicators — strength, wealth, spells — an hourglass to time your move, along with the occasional reports and details of 'followers' — non-player characters who can be enlisted into your band.

You move your character, a small black silhouette, by a simple left/right cursor with the occasional choice of compass points if you reach an edge. There are about 50 locations, though some seem rather similar. They are not all labelled.

You do not have to stop in a location but if you do you may be able to pick up objects which are strewn about. By stopping you also open yourself to attacks from the multitude of monsters who dominate the land. Spells can be used as well as brute force. Spells seem a bit surer — when I chose to be a mighty warrior I was defeated by a farmer, of all things!

Although it is not as big and does not have the crowds of characters who mill about in **Valhalla** it has a similar feel but with faster action. The graphics are limited and you should not expect something along the lines of **Knight Lore.**

What the game does provide is a relatively complete translation of D&D motifs to computer. If you have ever played board games like *Sorcerer's Cave* you will find this to be very similar. Learning to play properly will take practice as there is real-time action which needs fast responses. If you dither you are lost. Even with four players it is unlikely that anyone will be bored as the action can be quite entertaining, even to watch. This gives **The Talisman** an edge over text-based multiple player games. Very much for those who prefer arcade-style stimulation as there is no time for reflection once it is your turn.

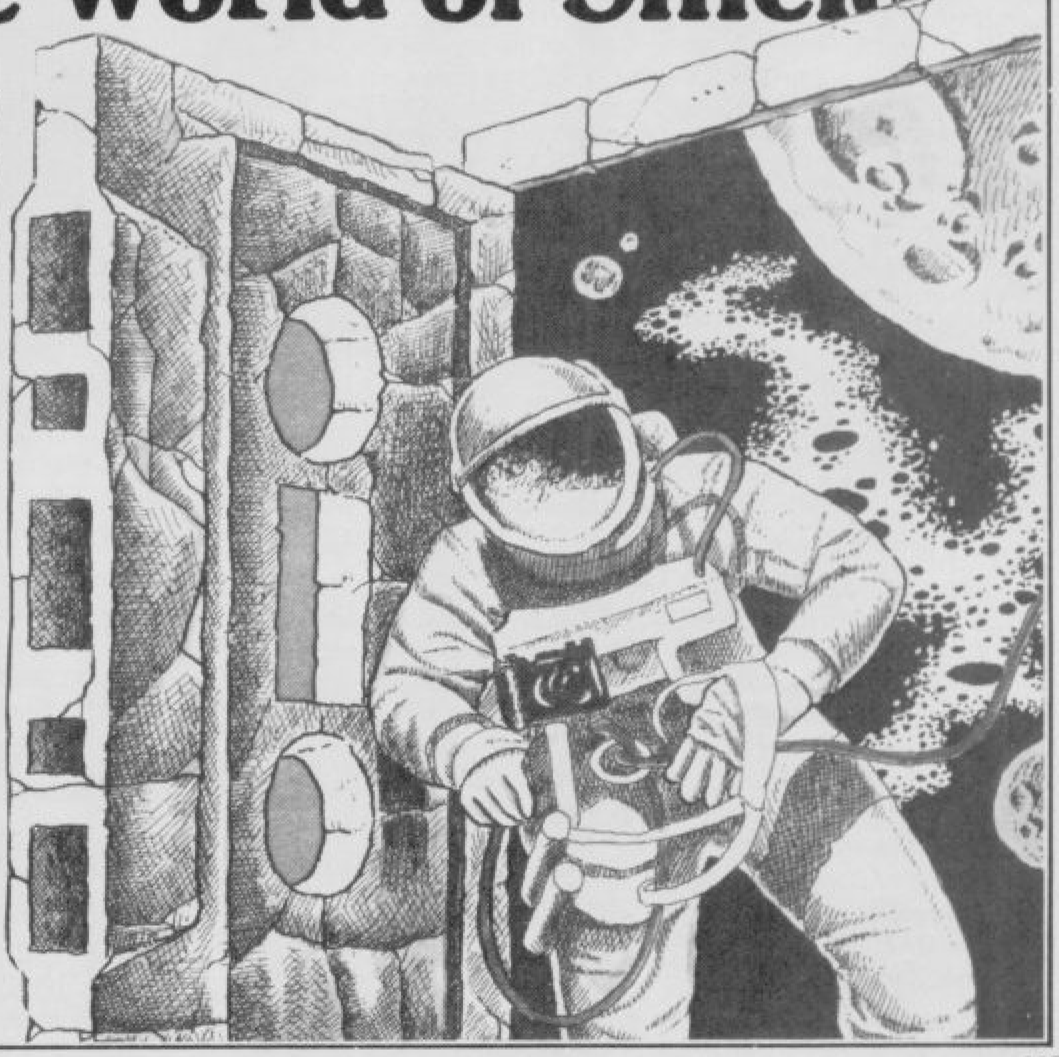
Underworld

Finally, let us get back to text adventure and institutionalised burglary with **Underworld: The Village** produced by Orpheus. The approach is straightforward — you read a report of treasure being found in a sleepy village, drive out there and start getting as much of it as you can.

The game is in traditional format — you will win if you get 20 items. You will run into puzzles quickly and will find deep holes, mine shafts and fading batteries within a few moves.

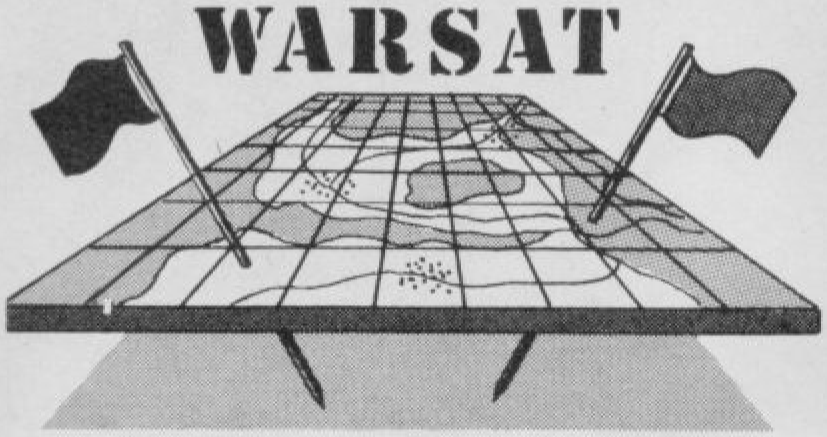
The screen presentation is dull — black and white — and the response from the interpreter to valid 'Exam' queries is too limited. 'Can you be more specific?' flashed up far too often for my liking, and I would have appreciated more versatility to enliven my explorations. The writers have not really used the **Quill** to its full potential and I found that **Underworld** compared poorly with **Confidential.** It is not a bad game but neither is it desperately addictive or compelling.

CONFIDENTIAL 48K Spectrum
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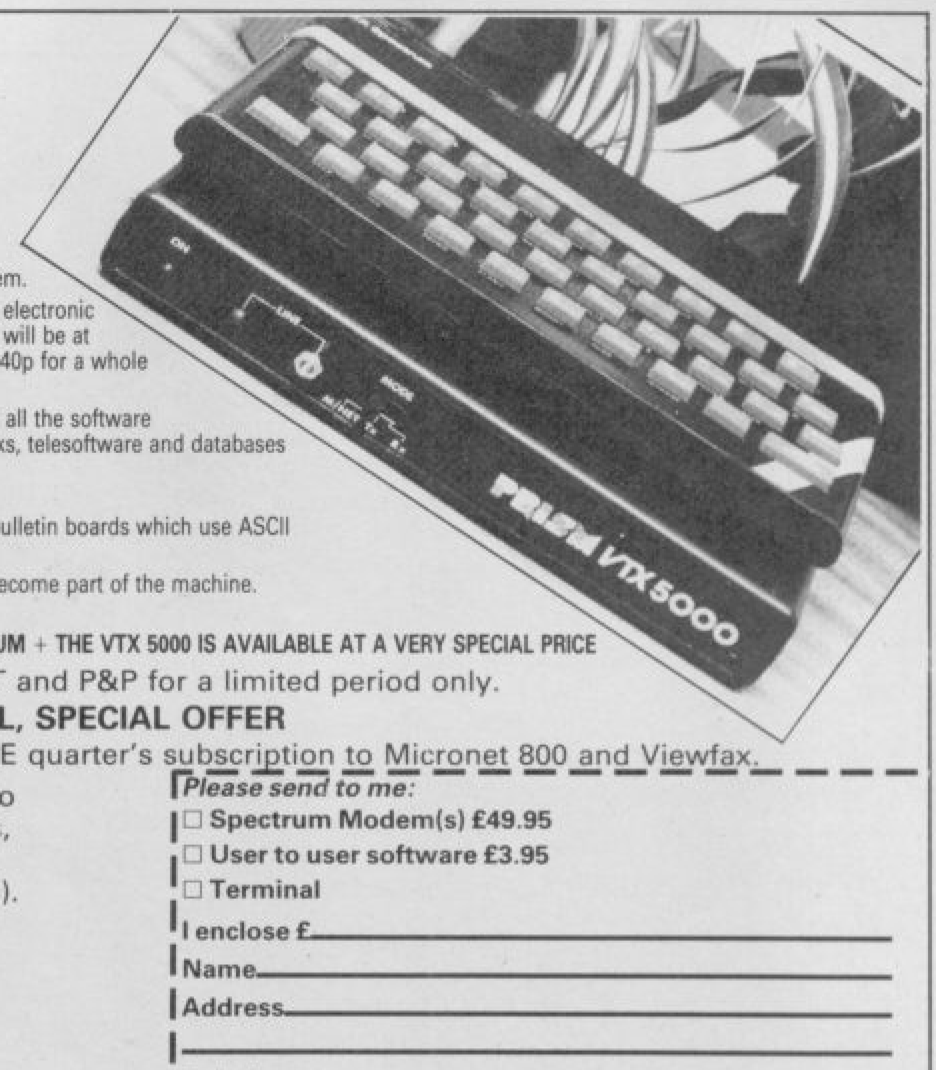
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Finally, **Penetrator** from Melbourne House is still one of the nastiest, toughest, fastest arcade games around.

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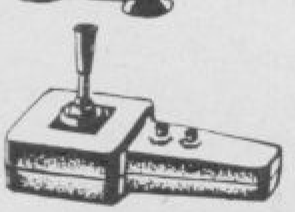
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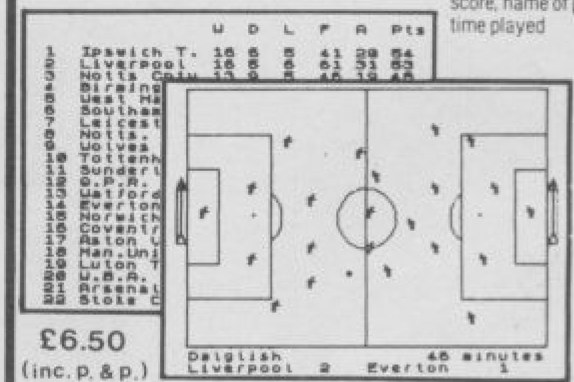
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Ignoring all advice against attempting his objective, the fearless mountaineer states, "people risked their lives to conquer Mount Everest, why not this challenge?"

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Word play

John Gilbert designs a phrase book for computer communication in AI adventures

COMMUNICATION is the most important aspect of any adventure yet it is the one feature which is handled in an archaic and confused fashion.

Many adventure games still use sentence interpreters which only allow a verb-action-and a noun-name-to be entered and understood by the computer. For instance GO NORTH would be understood but PLEASE GO NORTH, or GO DOWN THE ROAD TO THE NORTH, would not. The number of verbs and nouns defined for use within such an adventure is similarly limited to a couple of hundred words in a database.

That program structure and database organisation is not good enough if you want to make communication between player and computer easy and comprehensive. For a start you will not be able to get characters talking to each other with a verb/noun structure. A new approach is required which can be developed and demonstrated through **The Crysan Incident,** an example adventure game which is being created in this series.

So far in this adventure we have done without communication between characters. Kagan and Marla, the heroes, have done battle with monsters in the depths of the ocean in a desperate search to find the Crysan clock, a device capable of controlling the flow of time.

They have killed the monsters and have entered the doorway of the sunken yacht. There is a whirl of colour and Kagan and Marla are transported through a time warp to an underground kingdom of Kelros.

Captured by the Kelrosians, they are lead to the city of Carvad where they await an audience with the ruler. Communication is required between characters if Kagan and Marla are to survive. Not only will you have to tell the computer where you want to go but also negotiate with the ruler.

As with all the techniques in this series we do not want to re-invent the wheel so it would be sensible to look at and use some of the research and techniques already used in adventure games.

When adventure games surfaced in the 1960s they were programmed on large mainframe computers which had vast amounts of memory but inefficient, turgid, operating systems. The games were simple by today's standards and had a word dictionary of only 100 words or less. Many of today's games are similar to those programs, where communication is concerned, and it is about time that players are able to enter full sentences rather than rigid formulae.

The old games took in a communication string such as GO NORTH and split it up into two parts. It then truncated each word so that it consisted of only two characters. The sentence GO NORTH would, therefore, be GO NO. Only then is the sentence translated.

Translation occurred in one of two ways. Either there was a central database containing all the words, or the words which could be used within a scenario were dealt with within that specific scene. The second required more memory to accommodate the vocabulary and the first was restrictive as different types of words had to be universally classified such as movement, object and combat words. Objects had to be put into a similar database so that they could be manipulated if required.

The second approach, while using more memory, was easier to code, especially in Basic, and restrictions were not so tight. For instance, an object would be located in a situation and you would need words which could be used to manipulate that object. The manipulation could also be specific to the type of object which had been located, so you might have wanted, for instance, to stroke the cat but you could not drown it as there was no water around. Taking it to a scene which included water and the word drown could be used within that scenario. The cat could then be drowned.

The advantage of the second approach is that you can tailor the

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words needed to the situations. Conversely with the database approach you need to think of every possible word which might be used within the adventure and then find some way to execute them throughout the game in all situations.

Since the advent of the adventure game new ways have been introduced to make communication easier but many have restricted the way in which characters and players interact.

Typical of those techniques is the menu, or keyword system. For instance, a simple game may include the abilities to move and to take objects. You would press the 'G' key to enter the movement option and then, when prompted, enter the direction in which you wish to go. In a similar way you would press 'T', for take, then key and enter the name of the object which you wished to take. The system has been used in programs which opt for the universal word database method so that the options apply to all scenes within the adventure.

Each method has its pros and cons but all have some aspect which can be used in an artificially intelligent game. A definition of what we want to do, and how we want to do it, is in order.

We want a method which makes communication easy for the player and one which is adaptable to the adventure environment. It should also be possible to program easily and be easy to understand. Flexibility should be important so that the play can control the speed and form of communication without having to constantly refer to a help or instruction sheet.

We can establish two types of communication, one which is simple but limited and the other which allows the entry of full sentences and which can be adapted for each new scene so that some actions are possible in one place while not in another.

The menu, or keyword system can be used for the simple input routine and it can be universal so that the word understood can be applied to all scenes. A routine for GO, 'G', and TAKE, 'T', is shown in listing one.

The listing is open ended and you can add as many options as your adventure program requires. All you will need is a line to trap input after line 30 and a routine which should start as a clearly delineated section of the program structure.

For the purposes of the example an object has been placed in the scenario object indicator variable at line 5. In a full adventure each scenario would have a different value for this variable. For instance it may contain bucket and spade at the seaside or sword outside the sunken yacht.

Line 10 enters a character and lines 20 and 30 check to see if they are either GO or TAKE instructions. If they are not the Spectrum continues to ask for input.

If the input trap is crossed then INKEY$ will deposit a character in A$. If that character is not 'G' or 'T' the Spectrum will print 'I CANNOT UNDERSTAND' at the bottom of the screen. If 'G' has been entered the computer enters the 'GO' routine at line 60.

Line 60 is the start of a scene control module. The variables N, S, E, W, U, D refer to directions and the numbers which they hold are the subroutines containing the next scene if the player goes off in a specific direction. A zero shows that you cannot go in that direction.

Line 70 calls a subroutine which allows a direction to be entered and then checks to see if it is a valid direction. If it is, then the number, including zero, is put into variable B and a return is made to the main part of scene routine at line 80. If the direction is not valid zero is put into B and a return is made.

Once we get back to the main routine a check is made to see if the value of B is equal to zero. If it is, a message is given to the player, telling him or her that a move cannot be made in that direction, and we again ask for an instruction at line 10. If, however, all the checks have been made successfully we move to the next scene routine pointed to by variable B.

The TAKE routine, entered from line 30 and starting at line 100, is even easier than the movement routine. The player is asked which object is to be taken. The variable O$ contains the object which has been placed in the scene, a sword. If O$ was empty line 110 would display a message saying that no object matching the description in A$ can be found. A return is then made to line 10 where a further instruction is requested.

The rest of the routine informs the player that a 'take' is in operation and then adds the new item to the inventory string, I$, where it is separated from the previous object in the variable with an asterisk. The inventory can be scanned when required, by using the techniques developed in last month's article.

When the inventory has been updated a return is made to line 10 and a request for more instructions given. The quick entry system for the adventure is therefore almost complete.

Next month we will take communications further when we go all out with full sentence translation and investigate how to get the Spectrum and QL to understand and generate speech for characters. Then, in the final part of the series, we will look at ways of putting the whole adventure together, in listing form, and how to get characters to interact while you are entering instructions.

```
   5 LET o$="sword": LET i$=""
  10 PAUSE 0: LET a$=INKEY$: IF
a$="" THEN  GO TO 10
  20 IF a$="g" THEN  GO TO 60
  30 IF a$="t" THEN  GO TO 100
  40 PRINT #0;"I CAN'T DO THAT"
  50 GO TO 10
  55 REM start of move routine
  60 LET n=0: LET d=0: LET s=400
0: LET u=4050: LET w=5000: LET e
=5050
  70 GO SUB 1000: REM check entr
y
  80 IF b=0 THEN  PRINT "YOU CAN
'T MOVE IN THAT DIRECTION": GO T
O 10
  90 GO TO b
 100 INPUT "TAKE WHAT ";a$
 110 IF o$="" THEN  PRINT "THERE
 ARE NO OBJECTS HERE TO PICK UP"
: GO TO 10
 115 IF a$<>o$ THEN  PRINT "THAT
'S NOT HERE": GO TO 10
 120 PRINT "TAKING THE ";o$
 130 LET i$=i$+"*"+o$
 140 GO TO 10
1000 INPUT "Where to ";b$: LET b
$=b$(1)
1010 IF b$="n" THEN  LET b=n: RE
TURN
1020 IF b$="s" THEN  LET b=s: RE
TURN
1030 IF b$="e" THEN  LET b=e: RE
TURN
1040 IF b$="w" THEN  LET b=w: RE
TURN
1050 IF b$="u" THEN  LET b=u: RE
TURN
1060 IF b$="d" THEN  LET b=d: RE
TURN
1080 RETURN
4000 CLS : PRINT "You are in the
 throne room.     A huge throne,
 upon which a vastcreature rests
 its glistening   limbs, dominat
es the hall"
4010 GO TO 10
4050 CLS : PRINT "You push the K
elrosians back andrace up the da
mp stairs only to be confronted
by an abyss.  It  looks like if
you've had your   chips and the
Kelrosians are    about to have
theirs"
4060 GO TO 10
5000 CLS : PRINT "You race towar
ds and exit, hotlypursued"
5010 GO TO 10
5050 CLS : PRINT "You race to th
e door but are    tripped as you
 get there. You   fall heavily"
5060 GO TO 10
```

Listing 1

Ghosts in machine interrupt routine

Andrew Hewson explains why spare space appears to sit in memory



EVERY month I have the uneasy feeling that this time I shall have run out of interesting things to write about.

Finding a theme this month was, however, made very much easier because a large batch of letters arrived enquiring about the Spectrum interrupt system. I dealt with the interrupt mechanism before but clearly more detail is required. But first I shall answer some fairly straightforward questions.

The first is from Simon Shaw of Maidstone who is worried that he has found a ghost haunting the top end of Spectrum memory. He writes: **Whilst experimenting with machine code routines I became aware that some of the memory addresses above 65000 were corrupting and were filled with what appeared to be random numbers. The op-codes corresponding to the numbers in those addresses seemed to be complete nonsense. The sequence of numbers varies, depending on what program is held in RAM, but the start address of the sequence is generally somewhere around 65300. What is going on?**

Fear not, Simon, your Spectrum is not inhabited by some alien presence. What you are observing is the remains of the machine stack, the GOSUB stack and the definitions of the user-defined graphics.

To understand what is happening turn to page 165 of the *Basic Programming* manual — Spectrum Plus owners should turn to page 48 of the *User Guide*. There you will observe the various divisions in memory established and maintained by the software in the Spectrum ROM.

At the bottom is the ROM itself and above that at the beginning of RAM is the display file, which is followed by the attributes, the printer buffer, the system variables and so on. About three quarters of the way up is an area enigmatically labelled 'spare' and by the look of the diagram it would be easy to imagine that this 'spare' memory amounts to no more than a couple of hundred bytes which happen to have no particular use.

Nothing could be more misleading because the 'spare' space is the key to the operation of the machine. In normal circumstances there is no other empty memory in the machine; thus whenever extra bytes are required in any given portion of memory everything is shuffled along into the spare space and the system variables are adjusted appropriately.

That manipulation of memory takes place without the user being aware of it. For example, when the user selects the Edit facility he sees that the Basic line he requires is copied from the listing on the screen to the window at the bottom. He is unaware that the same copying process has occurred in memory — space is created in the editing area by shuffling the INPUT data area, the temporary work space and the calculator stack into the spare area. The contents of memory corresponding to the Basic line required is then copied into space which has been made available.

Now consider what happens when an area of memory is no longer required. That happens, for instance, at the end of the editing process when a reconstructed line is returned to the Basic program. This time the contents of memory are shuffled down to overwrite the contents of the Editing area and return the redundant memory to the spare area.

When the copying process is complete, the lowest part of the spare area will not now be filled with zeros, as it is when the Spectrum is first switched on. Instead it will contain an echo of its former use. For example, that part of memory which was previously allocated to the calculator stack but which, as a result of the shuffling process, is now spare will still contain calculator data.

Why, it may be asked, does the Spectrum ROM not fill the newly vacated memory with zeros as it does with all of memory when the machine is first switched on? The answer is that to do so would serve no purpose and would waste precious time. If the spare space is required again then the appropriate information will be copied into it and it does not matter to the copying process whether the material being overwritten is zero or not.

Once the machine has been used for two or three operations after switching it on it is surprising how much unseen garbage is left lying around. That is the origin of Simon Shaw's ghost. When RAMTOP is moved down, the old machine stack and GOSUB stack are left where they were but the contents are copied to a new location. Thus Simon is observing the remnants of the previous stack.

This discussion leads naturally into the following question from John Spinks of Harlow. He asks: **What are the machine stack and the GOSUB stack referred to in the Spectrum manual?**

Most readers will be familiar with the Basic GOSUB command. When the ROM encounters this command the Spectrum stores the number of the Basic line which it is currently considering, locates the line referred to in the GOSUB command and then continues execution from that point. When the next RETURN command is found, the stored Basic line is retrieved and execution recommences from immediately beyond the original departure point.

The GOSUB stack is the place

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where the line numbers are stored away for later retrieval. It works in an upside down fashion in the sense that it grows downwards when a line number is added and shrinks upwards when a line number is deleted. Thus it grows downwards in the direction of the 'spare' space.

The machine stack lies under the GOSUB stack and immediately above spare memory. As a consequence, when GOSUB grows and shrinks the machine stack is copied up and down memory in step. Spectrum Plus owners will observe that the machine stack is not actually named in the memory map although there is a corresponding slot on the diagram.

The machine stack is the place where the Z80 microprocessor stores subroutine return addresses and it can be thought of as similar to the Basic GOSUB stack. The machine stack also serves a separate purpose as a temporary storage area for the contents of the various Z80 registers. There is a group of Z80 PUSH and POP instructions to enable data to be stored and retrieved. For example, PUSH BC stores the contents of the B and C registers on the bottom of the machine stack and POP BC retrieves the contents of the bottom of the stack and stores it in the B and C registers.

Let us now turn to the interrupt system. Thanks in particular go to Simon Durrant of Hemel Hempstead who martialled a long list of questions on the topic, including: **What is the non-maskable interrupt? What causes interruptions to take place? Does the keyboard force interruptions to take place? How does the processor determine whether to go to a maskable or non-maskable routine? Could you describe all three interrupt modes?**

The interrupt system, as its name implies, is a mechanism by which the processor can be diverted from the task it is currently undertaking in order to do something which is more urgent.

All computers have an interrupt system and on more sophisticated machines they allow the computer to maintain a priority system for all the tasks which it has in hand at any one moment. A low priority task is deferred in favour of a more urgent one. As each task is completed the machine reverts to a previous, half-completed job.

Two types of interrupts can occur in the Z80. The more important is the Non-maskable Interrupt — or NMI — so-called because the programmer is unable to prevent, or mask, the Z80 from responding to such an interrupt when it occurs.

The maskable interrupt is of more interest both because it can be switched off — so that all subsequent interrupts are ignored — and because the Z80 can be set to respond to it in any one of three modes. In mode zero the processor simply waits until it is directed by an external device to execute a routine somewhere in memory. In the Spectrum there is no provision for the use of that mode.

The Spectrum is designed to operate in mode one all the time. In that mode the Z80 saves the contents of the program counter — so that it can later resume the task it was doing — and jumps to location 38h (56 decimal). The Spectrum hardware forces that jump to be made by generating an interrupt 50 times per second.

Priority tasks completed first as interrupt system takes control

The ROM routine at that address updates the clock by incrementing the FRAMES systems variable held at 23672 to 23674 and then scans the keyboard to see if a key is being pressed. If so, the appropriate code is stored in the systems variables and various flags are altered. On completion of the keyboard routine all the registers are restored to their previous values and the processor resumes its previous task.

The final interrupt mode, mode two, is the most powerful. If the Z80 is interrupted while in that mode it saves the program counter as before and jumps to an address partly determined by software and partly by the hardware which caused the interrupt. The Z80 takes the value in the I register and the value generated by the external hardware and calculates an address from them as follows:

Address = 256 * I register + hardware

It then looks at the contents of the calculated address and the subsequent one and calculates a new address from them:

New address = Address + 256 * (Address + 1)

It then jumps to the new address. Thus if the I register contained 143 and the hardware generated the value 27 the Z80 would look at the contents of

256 * 143 + 27 = 36635 and 36636

If those two locations contained 137 and 93 respectively — PEEK 36635 = 137 and PEEK 36636 = 93 — it would then jump to location

137 + 256 * 93 = 23945

That rather complicated procedure is known, aptly, as an indirect jump and is not as cumbersome as it seems. It enables as many as 128 types of devices to be attached to the Z80, each type generating its own value to contribute to the indirect jump address. The programmer then constructs a table containing 128 addresses each held in two bytes and each pointing to the routine that handles a particular device. The I register points to the location of the beginning of the entire 256 byte table.

It should be realised that an interrupt can be generated by any piece of hardware which is attached to the correct line into the heart of the Z80. On the Spectrum the hardware generates an interrupt 50 times a second and then the ROM software looks to see if a key has been pressed and looks after the display refresh.

Finally, Stephen Carter of Chilwell, Nottinghamshire, writes: **I have implemented the clock routine listed in your column in the March issue using the Picturesque assembler, but when I try to trace through it using the monitor it crashes. Why?**

I am not familiar with the Picturesque assembler and monitor but I imagine the problem occurs because both the clock routine and the monitor are attempting to use the interrupt system without reference to the other routine.

My clock routine — which updates a screen display of the time every 50th of a second — makes use of interrupt mode two. That is how the machine is able to update the clock whilst still appearing to function as normal. The Picturesque monitor presumably also wishes to grab control of the machine every 50th of a second by using interrupt mode two and setting its own vector.

The only answer is not to attempt to run the monitor and look at the clock, or any other routine using IM 2.

● *Please address problems and queries to Andrew Hewson, Helpline, Graham Close, Blewsbury, Oxfordshire.*

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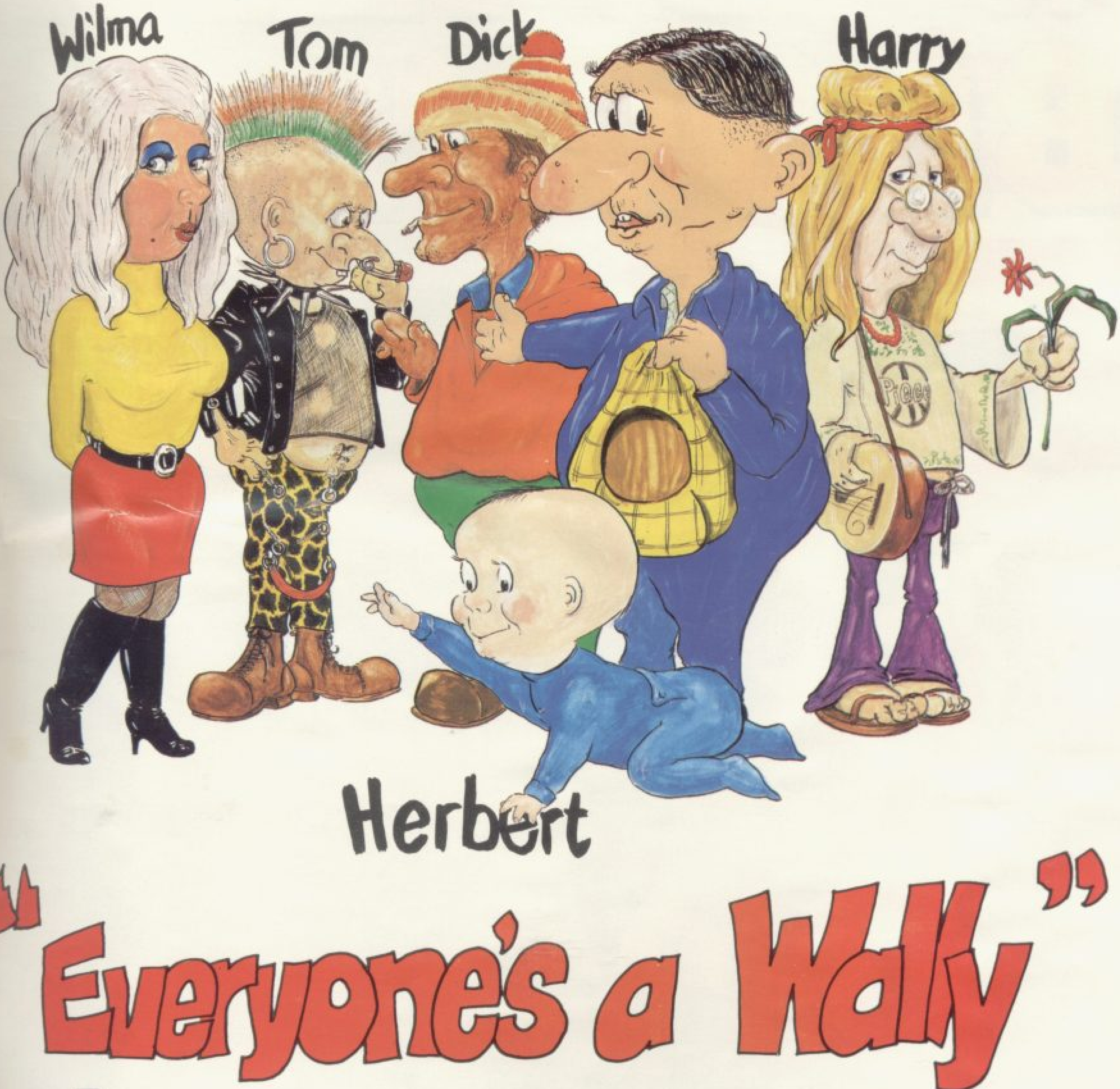
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